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HEALTH LECTURES

BY

WM. CHEYNE WILSON,

M.B., ED.,

PHYSICIAN ASST., PLYMOUTH PUBLIC DISPENSARY.

DEVONPORT:
W. ELLIS & SON, PRACTICAL PRINTERS, 1, CHAPEL STREET.
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PREFACE.

THIS little book is the outcome of a series of Lectures I was requested to deliver at Stonehouse some little while ago. Since their delivery many of my friends have asked me for them in a more tangible and lasting form, to which request I now gladly accede, thinking that not only will this book be of service to those for whom the lectures were especially prepared, but also that by finding its way among many others it will be the means of helping to raise the standard of health by the prevention of disease. At the time of writing the Lectures I had no intention of publishing them, and therefore did not mark the quotations and authors' names ; and to the latter I owe my apologies, as I am unable to trace their various sources, and I trust they will accept the same.

THE AUTHOR.

Plymouth, March, 1892.

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“*Use a little wine for thy stomach’s sake and thine often infirmities.*”
I Tim. v., 23.

DRINK AND THE DISEASES CAUSED THEREBY.

THE subject that I have chosen for the first of a series of lectures about to be delivered is one of vast and, I may say, paramount importance, not only to you as individuals, but also to the nation as a whole; for the abuse of alcohol not only affects you solely, but the evils resulting therefrom will be traceable in thousands, aye, tens of thousands, of children as yet unborn. Drink—by this I mean beverages containing ethylic alcohol to any extent—is the cause either directly or indirectly of a vast number of the diseases which, as physicians, we are called upon to treat, and as a cause of disease it stands pre-eminently in the first rank. I do not intend to enter even in the slightest degree into the moral side of the question, but leave that to those who are by far and away better able to treat that part of the subject, as I intend solely to treat it from a medical standpoint, but in passing it seems to me an interesting question as to whether or not the 120 millions of pounds spent annually on drink renders any equivalent service to the nation; and I must say that my opinion is on the negative side.

Alcohol exists in different proportions in the various wines, spirits and liqueurs that we are accustomed to see used, and I will briefly state a few of the most important of them. In

Kumiss (a Fermented liquor made from whey,) it exists in from ·3 to 1 volume per cent.
In German Beer e.g. Läger, from 3 to 5 vols. per cent.
In Hock, Claret and our Beer, from 8 to 11 per cent.
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Now, so that you may the more easily comprehend the effects of drink I will briefly run through its physiological action on the healthy organism, and as alcohol varies in its effects largely, according to the dose taken, I shall suppose that a moderately large dose has been imbibed; immediately it is swallowed it reaches the stomach and passes quickly (as it is rapidly absorbed) by means of small vessels, called lacteals, into the blood whence it is conveyed to the right side of the heart, from thence it passes to the lungs and there comes into close relation with air and here some of it is eliminated, that is given off by the breath, but by far the greater proportion passes back to the left side of the heart and thence through the aorta (that is the main artery of the body proceeding from the heart) into the general system of the body, and so you see that it comes to be related in a minute degree with every part of the organism. A part of the alcohol is eliminated by the various channels, but by far the greater part cannot be traced as such, and is probably broken up to form various complicated chemical compounds containing carbon, oxygen and hydrogen, which scientific men have failed to discover as yet. In the blood its effects are marked, if the dose be large, the blood corpuscles (these are really the essential elements of blood) are seen by the microscope to become altered in shape and to have a tendency to run together in "rouleaux" or rolls, and as these corpuscles are the carriers of oxygen from the lungs to the various parts of the body, it is evident that the oxygenizing power of the blood is decidedly hampered. Not only is this the case but also stagnation to a greater or lesser amount occurs, as this formation of rolls of the corpuscles to which I have referred must of necessity impede the progress of the sanguinous fluid in the smaller vessels, and if this happens often disease must be a sequel. The first effect noticeable after the entrance of alcohol into the system is a sense of heat all over the body as is seen in the blush of the face of any one who has partaken of alcohol to any extent. It increases the number of the pulsations of the heart and also increases the force of its beats and is therefore a stimulant. Now I will just refer a little more particularly to this effect of alcohol on the heart. Dr. Parkes, an eminent physician has made some very detailed scientific experiments on it, and by these we have been taught that the heart is made to do an enormous amount of extra work, which results in the end in a weakened muscular wall so that it gradually becomes worn out and is unable to do the duty required of it. Besides this action on the heart it also affects the remoter blood-vessels. The size of the calibre, that is the bore of the vessels, is regulated by muscular fibres which form a part of their walls. These fibres are intimately connected with the nerves of what is called the sympathetic system, and these nerves have a restraining power over the calibre of the vessels. Now alcohol paralyzes the sympathetic system, the result being a dilatation of the vessels as this restraining power is no longer in force. I hope I have made myself sufficiently clear to you. So now you see the cause of the sense of heat produced by alcohol, and that it is not by the greater force exerted by the heart but by this dilatation of the vessels. As the effects of the alcohol gradually pass off the restraining power of the sympathetic system re-asserts itself and the blood-vessels again assume their normal size. But in the habitual drinker such is not the case, and you here have a state of chronic paralysis of restraint, or in other words, dilatation, as is shown in the colour of the face and of that of the nose in particular which is a sure sign of the habitual tippler ; but mind you do not run away with the idea that every one who has a red face is a drunkard, for such is not the case, for some of our healthiest people possess red faces, due to excess of blood in their bodies and in no way due to alcohol ; but it is that peculiar tint only too well known to the experienced eye that indicates the over-indulgence in alcohol. I thought it better to refer to this *en passant* in order that you might not be led astray. This is what constitutes what may be termed the *first stage* of the actions of ethylic alcohol.

In the *second stage* the centres in the cerebro-spinal nervous system that are not influenced by the will are affected and ultimately paralyzed. The co-ordination of the several sets of muscles is gradually lost, and as a result we get the staggering gait, the thick and often incoherent speech, and the slow and inharmonious actions of the muscles.

The *third stage* constitutes that in which the individual's intellectual centres become affected and *thinking* is lost and the person becomes drowsy which passes into sleep or coma, that is complete insensibility.

In the *fourth stage* all the centres except those necessary for vitality (viz : those which govern the heart and those which govern the act of respiration) become paralyzed, and should the dose of alcohol have been very great the heart becomes paralyzed and death ensues.

Having recounted the various stages of alcoholic poisoning I will refer to one or two actions of alcohol more minutely. As I have shewn you alcohol is a *stimulant* in one respect and as such it is accepted by the generality of persons, it stimulates the heart, that is it increases the force and number of its beats, but this is its only stimulating effect and it cannot be called in any other respect a stimulant. In many diseases of the heart the frequency of the pulsations is reduced and the strength of the beat increased, and it is therefore a very powerful and effective agent in the hands of the doctor. But if we look at the other actions of alcohol we shall find that it is a *narcotic* (that is it produces sleep) and not a stimulant, (two almost contrary actions.) As I pointed out alcohol paralyzes the various nerves centres, firstly those of co-ordination then those higher intellectual ones, and lastly, the whole nervous system, which actions are entirely antagonistic to that of a stimulant. Now if we follow this a little further we shall find that alcohol should not be called or recognised as a stimulant in the ordinary sense of the term, for its stimulating action is always accompanied or followed by its narcotic action, the latter *more* than counter-balancing the former. Now let me exemplify this by some familiar examples. Now what should we understand by a stimulant to the nerves of sense? we should imply that it was some agent which would make them more sensible to the various external impressions or stimuli. Now take the special sense of sight, does alcohol affect it in this way? no, certainly not; it deadens its sensibility. The sportsman cannot shoot as well after having partaken of alcohol with his lunch, the cricketer cannot bat or bowl as well. Now take another sense, that of hearing combined with that of touch: the musician may be able to go on the stage with less nervousness, with a sort of Dutch courage, but he cannot manipulate his instrument so deftly. Now let us take some of the higher intellectual centres: the vocalist like the musician may lose a great amount of his or her nervousness, but he or she cannot sing so pathetically. Now let us take the man of letters, or author, and at first sight this seems to be an exception, for alcohol undoubtedly stimulates the rapidity of thought and also the imaginative and ideational centres, but here the train of thought becomes easily broken and the work of the writer or composer will not bear his own criticism on the morrow. Now let me refer to another action of alcohol which is erroneously understood by most people, namely: its effects on the animal heat or the temperature of the body. By a great number alcohol is taken on occount of its heat-giving properties as they imagine. How often do we hear of people having a drop because they feel cold. Now if you have followed me closely, you will understand that this is a delusion and a snare, and that instead of increasing the heat of the body it in reality reduces it; of course if the grog be taken with hot water the case is different for here the water may be of some good. The manner in which it acts has been vigorously discussed by the medical profession, and it was at one time thought that it was due to a check on the heat forming mechanism, that is by preventing oxidation (which is the great producer of heat in the body) but by researches by Dr. Ringer, and others, it has been demonstrated beyond doubt that alcohol increases the production of heat; but I have already pointed out its action on the blood vessels, and you can readily comprehend that although a greater quantity of heat is produced yet a greater proportion of it is lost from the body, as the blood circulating faster and in greater amount under the skin, as it does by the dilatation of the vessels and stimulation of the heart, must of necessity loose more of its heat as it comes into closer relationship with the air which is always much cooler than the blood. So although a greater amount of heat is produced at the expense of the bodily mechanism, yet you see it is lost altogether, and you can easily understand that this sort of thing cannot go on for a very long time, as the structure of the body is gradually being used up and the end of it must be physiological decay. Now I should just like to bring under your notice another fact regarding alcohol and that is that a great number of persons at the present day are taking poisonous doses of it daily; by poisonous I mean quantities of alcohol detrimental to health. To find out what was the least quantity of alcohol that could be taken without injury, was a matter of great difficulty; but Dr. Parkes has at length solved it. He made various experiments on a healthy man and came to the conclusion that from one and a half to two ounces of *absolute* alcohol was the limiting amount that could be taken per diem without any injurious actions resulting therefrom. Should this limit be overstepped, the bodily mechanism must suffer. Women he found were much more readily affected than men, and therefore the limit for them must be much lower. As regards children, all medical men are agreed that only in the direst necessity must alcohol be resorted to, as they are so easily affected by it. Now it is easy for you to know the limit of the various drinks that can be taken, if you remember the proportion of alcohol in them and which I gave you at the beginning of my lecture, not that these amounts if taken will be of any service to the body, far from it, for although not injurious in those quantities, it causes an extra strain of some of the organs. Mr. Whyte, of Manchester, has made some very interesting observations on this subject. The population of England at the time he made them was reckoned roughly at 24,000,000; of this number he counted about 10,000,000 as non-consumers, that including total abstainers and children which left 14,000,000 as consumers, and for these considerably over 2¼ oz. of alcohol was consumed daily. This average is much above Dr. Parkes limit, as we must make allowances for a great number of people who take considerably under 2¼ oz. daily. You see that a vast number of people must make up the deficiency and consume a great deal more than this quantity, and so you comprehend that there must be a great number of people who are daily consuming poisonous doses of this potent cause of disease. I will not here remark on the medical uses of alcohol as this belongs more properly to a medical lecture, and also because I have things of far greater interest and instruction wherewith to engage your time and attention. Before going on to mention some of the various diseases caused by alcoholic poisoning, I should like to point out that there are long and insidious trains of symptoms which often precede what we may actually be able to point to as disease of the numerous organs, and it is only when these symptoms come to a climax that we can say that disease really presents itself. It is wonderful how much licence can be taken without disease resulting therefrom, as the recuperative powers of nature are so great, that they repair mischief when not serious ; but although such be the case, yet nevertheless the—what may be called slight—symptoms are often only too surely a slow march to disease which is extremely hard to battle with even with all the resources to which a physician has access. If we could only recount the restless nights, the bad headaches, the shattered digestion, the general malaise and uneasiness, the morbid feelings and a host of such like complaints only too familiar to the habitual drunkard ; they should, I think, point out to us what a danger there is in the abuse of alcohol and teach us a lesson that we should be very careful and guard against the awful vice of intemperance. The danger lies in its treacherous and insidious encroachment, and no warnings of ruined health, not even those of death itself will prevent the victim from his indulging in the habit when once established as it gradually leads to weakening of the will. I will now pass on to some of the most important diseases caused by this agent.

DISEASES OF THE STOMACH.

The first to which I will refer are those of the stomach as it is in this organ that disease as a rule first becomes evident. Affections of the functional action of the stomach are more or less present in every case due to the excessive use of alcohol, which, as physicians, we are called upon to treat. In the first place it is absolutely necessary that for the effectual action of this organ of digestion there must be a requisite amount of gastric juice and also that the juice be of a normal quality ; then there must be what is called its peristaltic action whereby the food is kept in motion and thus all of it becomes thoroughly mixed with the juice, and lastly a certain temperature is necessary for the conversion of the albuminous substances into soluble chemical products called peptones. Now you can see how easy it is for alcohol to upset these functions altogether, for it (if taken in anything but the smallest quantities) completely alters the characters of the gastric juice so that it no longer does its duty. The peristaltic action to which I have referred is also more or less affected, and the temperature is often reduced. If it be taken in larger quantities it irritates the walls of the stomach and they become congested, and it may give rise to acute inflammation of the organ. Here the glands of the stomach which secrete the juice partake of the inflammation and thus you get an abnormal formation of the juice, then the walls of the organ often become coated with a thin layer of mucous which prevents the food from coming into contact with the juice. Should the indulgence in liquor be abandoned the stomach again returns to its normal condition, but if, as is only too often the case, the excess is continued then the stomach passes into a state of chronic catarrh or inflammation. Here the walls become greatly thickened due to the great formation of connective tissue (that is the tissue connecting the various glands, &c. together) and this constricts the glands and prevents the gastric juice from being poured into the stomach, and they ultimately become bags or cysts. Now the effect of all this on a patient's health you can easily imagine, for the food, when the stomach passes into this state, is of little or no service, and were it not for the spirit that they take at this peoriod they would almost die of starvation. Now these diseases of the stomach give rise to various symptons. In mild cases the sufferer complains of sickness, disinclination for food, a feeling of discomfort in the region of the stomach and often pain, there may be present heartburn or nausea, and in a number of cases flatulence, due to the decomposition of the food into various acids by fermentation, the chief of which are butyric, lactic, and acetic. After a time the appetite is lost and the only crave is for more drink to appease the uncomfortable sensation in the stomach. This inflammation often extends to the intestine, giving rise to different trains of symptoms into which I have not at present time to enter.

DISEASES OF THE LIVER.

I will now pass on to the diseases of the liver caused by drink, and here we have a number of varied complaints, and of all the organs of the body which become affected this takes front rank ; and you can easily understand this when I tell you that the liver abstracts various substances from the blood, acting as its purifier. In it is also formed a substance called Glycogen, which is easily changed into sugar ; but its chief function is that of forming bile, a fluid which helps in the digestion of fatty matters, and also helps as a disinfectant. Some three or four pounds of this are secreted daily. Before mentioning the various diseases I will tersely explain the structure of the liver. It consists of a multitude of very small cells which are grouped together to form lobules which are about 1-20 of an inch in diameter. Now if we examine a lobule we shall find that entering into its formation are the very minute branches of the portal vein, hepatic artery, and hepatic vein, and the spaces between these are filled with the cells to which I have referred and which really compose the greater part of the organ. The blood which is plentifully supplied to the organ is in close relationship with these cells and they abstract the various substances contained in the blood, and alcohol, arsenic, &c. remain in the cells for a considerable time after they have been absorbed, and thus it is, in cases of poisoning by the latter, when all evidence of it has disappeared from the stomach it can readily be detected by chemical analysis in the liver. These lobules are surrounded by connective tissue and are grouped to form larger systems which are called lobes. Now alcohol increases the action of the liver and gives rise to congestion of that organ, giving us all those symptoms so well known as bilious attacks. Hepatitis, or inflammation of the liver, is also caused by drink which often leads to a fatal result. Abscess of the liver although not so common in our country is also accelerated by it. But by far the commonest disease of all is what is medically known as cirrhosis. It is also called "hob-nailed" liver on account of the peculiar appearance that it presents, the surface looking as if studded with hob-nails, giving it a rough and rugged surface. It is also commonly designated by the name of gin-drinker's liver as this disease was very prevalent in London in those who died there, from having recourse too often to the gin bottle. In the early stages of the disease, the liver is enlarged, due to an exudation into the tissue connecting the lobules together, and this enlargement is fairly proportional all over the organ; but after a time it becomes transformed into fibrous bands, and these ultimately contract, and by so doing they press on the liver cells, which become gradually smaller and smaller and some of them disappear altogether, as they are unobservable through the microscope under the highest powers. The circulation also becomes interfered with, and thus the liver does not receive sufficient blood and it leads to dropsy and death. This contraction naturally diminishes the size of the organ, which goes on until the liver gets to be often smaller than half its normal size. You also now can understand the cause of its hob-nailed appearance, as these bands where they are attached to the membrane covering the outside of the liver when they contract, draw in that part, whereas the remainder of the lobule being composed of cells, and not fibrous tissue does not, but bulges outwards; the pressure on the cells by the contraction of the surrounding fibrous bands in no small part contributing towards this. There is just another point in connection with diseases of the liver to which I will refer and that is that Diabetes is said to be sometimes caused by over indulgence in alcohol, although this point is somewhat doubtful; but *prima facie* it seems that such may be the case as I pointed out to you that

Glycogen, a substance easily changed into sugar, is formed in the liver in large quantities, and any interference with the organ might lead to the over absorption of sugar into the blood.

DISEASES OF THE HEART AND BLOOD-VESSELS.

I will pass on to the diseases of the heart and blood-vessels. The first to which I wish to draw your attention is the one known as fatty degeneration of the heart. I have mentioned that alcohol causes the heart to beat much faster, and also more forcibly, and thus it has to do a great amount of extra and useless work ; and this alone is sufficient to explain to you that this degeneration is likely to occur. The heart fibres become changed into fat, and it is therefore unable to do its work properly ; the beat becomes feebler, and should any extra strain be thrown on the heart it may cease to beat, suddenly, at any time ; so you see it is a very dangerous malady.

The next disease that will engage our attention, is that of fatty infiltration of the organ. Now alcohol prevents oxidation from taking place in the various tissues, and the fat is therefore not so quickly used up as it should be, for it must necessarily be oxidized for its conversion into other chemical compounds to be of use to the body, and as this does not take place fat becomes deposited in the various organs, and it has a predilection for the heart. You all must have noted that the over indulgence in liquor gives rise to obesity, which is nothing else than this deposit of fat in the omentum, a membrane situated in the abdomen. This accumulation of fat between the muscular fibres of the heart, necessarily hampers its action, and causes breathlessness on exertion, and a feeling of depression over the region of the heart as the chief symptoms. In some cases it leads to death, by failure of the heart's action. The blood also becomes deteriorated in alcoholic poisoning, and it becomes unable to fulfil its life-giving function properly. On the blood-vessels, alcohol also acts in a detrimental manner, and the larger of them are especially apt to suffer. The deepest layers, that is those nearest the bore of the vessels, become irritated and inflamed and a deposit takes place in them which sometimes takes the form of caseous or cheesy masses, whilst at other calcareous (chalky) matters are deposited. In the latter case the arteries become rigid and do not dilate as they should at every increase in the blood stream caused by the heart's contraction, and this therefore causes a great strain to be thrown on the heart, which becomes enlarged. This calcareous deposit also gives rise to what are called aneurisms, for it makes the vessels' walls weaker and ulceration occurs at some spot, and the extra pressure makes the wall at this particular point bulge out and gradually to get thinner and larger until it ultimately bursts and causes death by the escape of the blood.

DISEASES OF THE LUNGS.

On the lungs also, alcohol exerts its baneful effects. Congestion of the lungs and pleura (the membrane surrounding them) occurs in conjunction with the general congestion consequent on the abuse of this article, and renders the patient very liable to pleurisy and pneumonia (inflammation of these organs). It also causes one of the varieties of phthisis or consumption and certainly predisposes to another form. Koch, the able micro-pathologist has demonstrated that one form of consumption is caused by a micro-organism called the tubercle-bacillus, and it is certain that congestion of the lungs predisposes to the disease as then these organs form a nidus wherein the micro-organism can flourish. There is also ample evidence forthcoming to prove that the off-spring of alcoholic parents are very liable to consumption. There is also the special form of consumption which I have mentioned, as caused by alcohol, and it has certain similarities to the disease I have described as the gin-drinker's liver, for here, as in the liver, the connective tissue seems to be primarily affected, becoming enlarged, due to an exudation and this presses on or occupies the place of the air-cells, and they cannot do their duty. Before passing from the diseases of the lungs I should like to mention a fact well known to all physicians and that is, that the mortality of patients (if alcoholic) suffering from pneumonia or inflammation of the lungs is very high, few, if any of them recovering.

DISEASES OF THE KIDNEY.

Diseases of the kidney are not of so frequent occurrence as those to which I have already referred, but they are of sufficient importance to justify my mentioning of them. The disease known as one of the forms of Bright's disease is undoubtedly caused by excess of alcohol in the blood, and here the albumen passes through the membrane of the kidneys instead of remaining in the blood, which in the end results in disaster, for it causes a continuous drain of albuminous substances to take place from the blood. The formation of calculi or stones is also favoured by drink.

DISEASES OF THE EYE.

There are a few functional diseases of the eye, to which I should like to refer, caused by this potent factor. Specks appear before the visual field: sometimes they are stationary, whilst at another they move about. They generally are black but in a few instances they appear to be coloured, the colours being very bright in some cases; these bright ones seem to be due to small hæmorrhages into the watery fluids of the eye. Then also small bodies, somewhat after the shape of a fly, appear before the sight, medically known as *muscæ volitantes*. Whether these various functional disturbances of vision are due to any structural derangement of the eye seems somewhat doubtful, they seem to be dependent on the stomach, which organ I have pointed out suffers considerably, and this affects both the nervous system and the blood-vessels of the eye. There is another affection of sight, which is functional, called alcoholic amblyopia. Here the patient comes to you (and he often seems to be the picture of health) and complains that he has been gradually losing his sight for some considerable time. On further investigation you may find out that it began as a sort of mist so that he could not see distinctly, and now that everything seems hazy and that he cannot discern the outline of various objects; you find that glasses are of no use, and you have recourse to the ophthalmoscope (an instrument for looking at the back of the eye) and you may discover there is some slight congestion present, but nothing else of any moment, and not being able to find out sufficient cause for the complaint, you question him more closely and discover that drink is the cause of it all, which, if it be discontinued the eye returns to its normal condition. But should recourse to the alcoholic stimulant be persisted in, certain structural changes take place—the optic nerve gets inflamed and then atrophies, and sight which cannot be restored at this stage becomes lost.

DISEASES OF THE SKIN.

There are various diseases of the skin caused by alcohol, the chief of which are Erysipelas, often a very dangerous disease, especially when it affects the head, as it leads to inflammation of the brain, Acne, where the skin becomes raised in red spots, and Eczema, the commonest and often most troublesome of all skin diseases—in the first stage of which small vesicles make their appearance which ultimately become filled with pus or matter, then they burst and the exudation forms crusts or scabs; every case does not pass through these several stages, for the disease may be arrested at any stage. So you see we have in reality three varieties—the vesicular, the pustular, and the formation of scabs.

DISEASES OF THE NERVOUS SYSTEM.

Now these bring me to the last but one of the various systems affected by drink, and that one is the nervous system. The diseases affecting this division of my subject would supply me with ample food for another lecture as they are so numerous and of great importance, but I will just slightly run over some of the commonest. The first that naturally presents itself is that one called Delirium Tremens. This is of very frequent occurrence and is one of the commonest diseases of the alcoholic patient known to the physician. He complains of various delusions, illusions and hallucinations of sight and hearing, he imagines he sees something or somebody, or hears peculiar sounds which have no real foundation, or he thinks he is somebody else, or he misinterprets various objects, as, for example, he may take some object near the bed to be someone who is going to kill him. Then there is the feverish state, the quick but often weak pulse, the excessive perspiration, the disordered digestion and furred tongue, and a variety of other symptoms more or less alarming. The subject of Dipsomania I must leave as time will not permit of more than its mention. Then there are the diseases called Epilepsy and Apoplexy, the latter a very dangerous one indeed, frequently caused by the abuse of alcohol. Then the various diseases included under the head of Paralysis, also caused by it, and the various forms of Insanity.

Now just a very few remarks on the hereditary effects of this certain and effectual generator of disease. Now the first fact I wish to mention is that the progeny of drunkards are often addicted to drink and this may pass on through various generations until it becomes so great in the latter ones that the race ultimately becomes extinct. Such a picture has been drawn by the celebrated French writer Morel, who has traced the genealogy of intemperance in more than one instance.

Now secondly, the effects of alcohol on the body generally, and on the brain in particular, are to arrest their growth, so the children are generally stunted and of defective brain power, the latter varying from slight defects of the mind down to idiocy. In the latter case the person often is nothing more than an automaton, being unable to express a wish, and being only a shade better than vegetable life; often the animal part of their nature may be well developed but the higher intellectual centres are very feeble or completely wanting, and any sense of morality absent; such a case is indeed sad but nevertheless true, and to think that the noblest on God's earth should be brought to this through drink is enough to make one shudder. About 30% of idiots are the children of drunken parents.

There are also various diseases of children which we can never estimate, caused by the want of food and clothes, dirt, &c., the want of negligent parents, the primary factor of that negligence often being drink. So you see we may sum up the hereditary effects of drink under two heads—(1st) that the children are generally stunted, (2nd) that there are various abnormalities of the brain due to perverted or arrested development.

Now I have laid before you to-night a great number of diseases caused by drink, not that all these diseases are caused alone by it, far from it, for there are also causes over which we have no control which may give rise to some of the diseases I have mentioned, so you must not suppose that anyone suffering from any one of the complaints I have named must have indulged too freely in alcohol—I just mention this for fear that you might draw a too hasty conclusion in the case of any of your friends (and thus perhaps mar their character) and say you are sure of it because a doctor told you so.

Before bringing this lecture to a close I should like to say a few words on a subject that is not within the limits of the present lecture on " drink." But although it is not the abuse of alcohol to which I would refer, yet nevertheless it is the abuse of one of the beverages which modern civilization has given us as a luxury and the evil of which is growing upon us every day; it is the abuse or rather excessive use of that article tea. Many of you must have been struck with the strides the sale of this excellent beverage has made of late years, and if no other evidence was forthcoming of the increasing quantity of tea that was daily being sold, it is only necessary for one to look at the various shops or even in the daily papers to see the great number of differently designated and flavoured teas that are being advertised, and one may rest assured that if an article is being largely brought before the notice of the public, it is largely in demand ; for were the demand not great, so many different firms would not supply the want, for in these days of such hard competition, firms—and the same relates to individuals—only too eagerly sell articles that are in demand. This beverage is abused by both sexes alike, although in most places it is the gentler sex who are the chief offenders. Women, one finds, are oftener the culprits in the hotter climates, but the further we go north the greater the number of male offenders become, in fact in some of the the islands on the north coast of Scotland the teapot is on the hob all day, being replenished as occasion demands ; the men and women helping themselves as often as they wish, which is a great many more times than that compatible with health. We can easily understand how it is that women are chiefly to blame, that is taking the whole of the tea-drinking countries right through, for of course, men, those " lords of creation " have their pipes and glasses of wine, and women must take something when they think they want a stimulant. Any one who has acted as physician to a large dispensary will tell you how dyspepsia—the result of the abuse of tea—is greatly on the increase and especially is this to be noticed in the female sex. The number of cases of indigestion, with all its uncomfortable symptoms, that one daily sees clearly traceable to this beverage is very large, and there can be little doubt as to the cause in many instances, as, by merely stopping or limiting the use of the infusion of tea, they become completely cured with little or no medicinal treatment whatever. The reason why so much harm is done in a number of cases is not so much on account of the quantity taken as the faulty mode of its preparation. The leaves of the tea-plant contain two substances: Theine, the active ingredient which gives them their stimulating properties, and Tannic Acid in some form or another, to which we owe the astringent quality. The former, when we make an infusion of the leaves, is abstracted pretty quickly while the latter takes a much longer time, so you can perfectly understand that as we wish to get as little as possible of the latter substance in our infusion we must leave it to soak for only a short period, for the longer it is soaking the more hurtful it is becoming. You are all perfectly cognizant of the fact—and especially is it the case in the poorer classes—that where tea is largely made use of, the teapot is on the hob more or less all day, and it is usually replenished by adding fresh leaves to those already there and as you see thus becoming hourly more harmful as the Tannic Acid is getting more and more in quantity. Now if it is necessary to use so much tea why not make it so that it shall contain as little of that hurtful substance, Tannin, as possible ; if this were only done the cases of Dyspepsia would greatly be diminished. Rather than using so much tea I think you would find that cocoa was preferable, as there you do not have Tannin present, and it is very quickly made, the only thing necessary for its effectual preparation being boiling water, and the Cocoa prepared by Messrs. Fry or Cadbury will be found to be perfectly pure and easy of digestion. With these few remarks which I hope will have a beneficial effect I must bring the subject of tea drinking to a close.

In conclusion I hope that the sad pictures I have drawn in many instances may make you ponder over this great question for knowing the havoc and disaster caused by over-indulgence you can all realize the dangers that are ahead, and so by virtue of your reasoning faculties make sure that you will do all that lies in your power to prevent this only too certain producer of disease, and often death, for by so doing the generation in which we live will of necessity become much healthier, and, not only this for thousands which are as yet unborn will have to thank you for the vastly improved standard of health. I must thank yon all for your kind attention and hope that my efforts, although I am afraid feeble, to make this evening's lecture interesting have not been unsuccessful.

THE CRAVING FOR DRINK.

There is no sight sadder in this world than that of a human being physically as well as morally ruined by the love of strong drink. The desire and subsequent habit, in most cases arises insidiously. A person is tired or harassed about business and a "pick-me-up" does seem to give one vigour, but what is overlooked in the fact that the stimulation is always followed by a reactionary depression. The idea that a glass of hot toddy keeps out the cold is even more erroneous; it certainly gives the sensation of warmth by driving the blood more rapidly, but from this very fact more of it comes to the surface of the body and is there cooled, and from actual experiment it has been shown that the body heat may soon be one or two degrees Fahrenheit lower than it was before the alcohol was taken. The habit once set up grows upon the individual until one sees him a broken-down drunken wreck, probably the victim of delirium tremens. Now alcohol is not a necessity: a cup of hot coffee will stimulate and warm better than a glass of hot grog, and *Caffyn's Malto Carnis is better still. With hot milk it makes an excellent drink, stimulating without any subsequent reaction, and more than that it is most nutritious. It may thus be given in the treatment of inebriety with most satisfactory results, and a warming drink can be made by adding it to a basin of hot arrowroot. Malto Carnis itself is the pure juice of meat extracted by pressure only, in combination with Extract of Malt and Cocoa. It contains the albuminoid principles which other extracts do not, and is therefore most nourishing, and at the same time it is stimulating, in fact in every way it will be found an ideal drink.

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CLOTHING.

"*Let each his adamantine coat gird well.*" P. L. vi.

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CLOTHING.

IN choosing the subject of my second Lecture, many may be surprised as it is none other than that of Clothing. Many may wonder and think that it is a strange subject for a medical man to dilate upon, and that it is somewhat out of his field, but as I mentioned in my last lecture the object of these addresses was that they should be the means of preventing disease (that is by eliminating preventable causes), and when you come to review the various causes of departure from the healthy standard you are struck by the fact that next to eating and drinking, clothing stands highest as a disease producer, or rather by a disregard to the common laws and *rationale* as to how we ought to clothe ourselves, and so I need offer no apology for the subject I have chosen.

Have you ever thought of the very healthy standard of the animal kingdom as compared with ourselves? You must have noticed the immunity from disease there is in the brute creation. Have you ever tried seriously to solve this problem for yourselves, if so, you must have come to the conclusion that the difference is caused by man being naked and having a reasoning power of his own. He selects his own food, he chooses his own clothing; not so the animal—and to these must be attributed the difference of the mortality in the two. The lower animals as you know are born with their clothing, and their instinct serves them to select their food, but man has to clothe himself and to select his own food according to his own ideas, many of us widely differing in our selections. Then fashion steps in and many bedeck themselves in most unscientific garb, much to their health's detriment. Every one knows that both eating and drinking (the latter of which I showed last week) cause a great number of our sickly brethren, and there can be no reasonable doubt I am sure with any one here to-night that errors in our clothing are also responsible for disease in no small degree. Now what is the use of clothing? As you know those who lived in the warmest parts of the globe wore little or no clothing (I am speaking of prior to the date when civilization reached them, for since the white man has mixed with them they have donned attire, although they could live just as healthily without clothes), whilst those who inhabit the Arctic regions have recourse to the warmest of materials for their garments, *e. g.* furs, &c. What lesson do we draw from these observations, why this, that clothing is used to try and regulate the temperature of our bodies by preventing or not the escape of heat from them. If the temperature of the atmosphere were always the same as that of ourselves there would be no need to make use of garments. Our normal temperature is about 98·6° F. whilst that of the air about this time of the year out of doors is about 50°F. to 60° F., and so we must need have something to clothe ourselves with so as to prevent the loss of heat from our bodies which must necessarily take place. Now it must be patent to all that the general principles of clothing must be in relation to that structure of the body with which it is in contact, namely the skin. So in the first place we will examine it. The obvious object of the skin is to form a protecting layer over the body to the blood-vessels and the fine network of nerves spread over its entire surface, and should this covering be removed or be too thickly formed on any particular part the result is pain as is exemplified by blisters and corns, these often being caused by bad clothing in the shape of illfitting boots. The skin is composed of two parts, the *Cutis vera* or true skin and the cuticle or *epidermis* together with some connective tissue. The *epidermis* consists of several layers of cells, the upper ones of which are scaly and are shed in the wear and tear of the body. This cuticle is entirely devoid of sensibility as it is not supplied with any nervous filaments; some of you must have seen it cast off entirely, as in the case of Scarlet Fever, sometimes forming moulds of the fingers or even of the whole hand. You may also see some of the cells being shed in what is popularly known as scurf, or you can often rub them off with your hands on a cold day making your skin feel rough. The *epidermis* being in reality a protective covering for the true skin varies in its thickness in different parts of the body, being thickest in those parts most exposed to wear, and where any part is subjected to pressure or friction the cuticle becomes thicker, a corn is primarily nothing less than a collection of cells, this part of the skin being made to grow faster and therefore thicker by pressure. If you compared the hand of a labourer, especially one whose hands are used muchly *e.g.* a blacksmith, with that of someone who never uses his hands for much work, you can see, nay, even feel the difference, being hard in one and soft in the other case. Nature uses this part of the skin to help clothe her subjects, for those who are badly clad and exposed much to the wind and weather have it more thickly developed. Physiologists have divided the *epidermis* into four layers, viz. (1) Rete Malpighii or *rete mucosum*, (2) Granular layer, (3) Stratum lucidum, (4) Stratum corneum. The Rete Malpighii is made of several layers of polyhedral cells superimposed the one on the other and are connected to each other by fine fibres with small spaces here and there to allow of the circulation of fluid in order that they may be kept damp. This layer is that which rests on the true skin, and in its deeper layers are found pigment granules, and on these depend the colour of the skin, being most numerous in dark coloured people.

The Granular layer is immediately external to it, and external to this again is the Stratum lucidum, so called from being formed of membrane which is homogenious. The outer layer of all is the Stratum corneum which consists of a number of layers of horny scales, and it is this layer which varies in different parts of the body.

The Corium or true skin is composed of connective tissue and in it are imbedded the various important organs of the skin, such as the nerves, which gives you the sense of touch, pain, &c., the blood-vessels, the glands and their ducts and the hair bulbs. The nerves are also in connection with the blood-vessels and cause them either to dilate or contract, the former, as in blushing and the latter, as when the skin is subjected to the cooling influence of the air. The Corium is raised up into points or papillæ which fit into corresponding depressions in the Rete Malpighii of the cuticle. Immediately under the true skin and between it and the muscles is a layer of fat, fat is also present in the Corium. The glands of the skin consist of two sets—the sebaceous and the sweat glands. The sebaceous glands are connected with ducts which open in most cases into the hair-follicles, and they secrete a peculiar oily substance. The sweat glands are the most important, they are situated in the fat beneath the skin and from them proceed ducts which open on the surface of the skin forming those little pores which you can see. This duct conducts the sweat from the glands to the surface, and it is unbranched and passes outwards in a peculiar spiral manner not unlike a cork-screw. These glands are very numerous something like 4000 to every square inch of the body so this will show what a vast system this is and what a great part it must play in the animal mechanism. The secretion of sweat is constantly going on but in such a small quantity (if we are at rest and not exposed to any high temperature) that it immediately evaporates as it pours out from the mouth of the duct, and in this state it is quite invisible; but should we be exposed to a great heat or should we get excited or frightened then the sweat is poured out more abundantly sometimes appearing as beads at the mouth of the ducts. This is due to the fact that the glands are in connection with nerves and when they are stimulated we get a larger secretion of sweat. Now as sweat is such an important secretion of the body we will examine it a little more closely. In order that the weight of the body be evenly retained it is necessary that the amount of nutriment introduced into it shall be compensated by an equable loss of matter, and the sweat is one of the means whereby this loss is constantly taking place, it acts as a purifier to the blood, the sweat glands abstracting the materials from it after they have been made use of in the body, and it is found that in diseases of other organs of excretion, such as the kidney, these sudoriferous glands become more active and make up for the work that ought to be performed by the kidney, and so you see it is a sort of help-mate, doing extra work when required. Now so that you may better understand the use of sweat I will briefly explain its relation with the interchange of material that necessarily takes place in the body. You all know that the various matters in passing through the body become changed. If we take a drop of water it passes from the body as water with different substances dissolved in it, but if we take meat, butter, or any of the varied articles of diet they become changed into complex bodies before they emanate from the body. Now let us take the instance of water and compare it with meat as it passes through the system. Water when drunk passes into the stomach and is rapidly absorbed into the blood, passing by means of small vessels lining the stomach, it passes to the heart and then through the systemic circulation and then to the skin or kidney, in the former case it passes into one of those small vessels near the sweat gland and the latter by a peculiar property of its own abstracts it from whence it passes up the duct to the surface of the body. A similar action takes place in the kidney, the renal epithelium acting as the sweat gland, then it passes into the bladder. Common salt, in fact any of the salts taken with our food, pass out in the same way more or less unchanged. Now let us follow a piece of meat : it reaches the stomach and is there acted upon by the gastric juice which converts it into what is called peptone—a soluble fluid—and it passes into the blood where it reaches any organ capable of acting on albuminous bodies and here it becomes used up, the result of this being the formation of a very complex body called urea ($CO(NH_2)_2$.) This urea passes into the blood, as it is harmful to be left in the body tissues, and then passing to one of the excreting organs, say the skin or kidney and passes off from the body. So you now see that the skin is really a blood purifier. From one to two pounds of sweat are secreted daily, varying in quantity with the temperature. Its chemical composition is as follows :—99½ per cent. water and ½ per cent. salts, urea, &c. These salts, &c. are as follows :--mineral salts ·25, urea ·004, fat, &c. ·246, total—·500. Sweat is a clear watery fluid, having a saline taste and usually an acid reaction. Besides the water and salts mentioned as being given off from the skin there is also a gas excreted, called carbonic acid, although this happens only to a small extent, and so I need only mention the fact. It is very interesting to compare the various organs of excretion for a moment. The lungs, (one of the chief of these) gives off carbonic acid in great amount, the kidneys on the other hand chiefly excrete urea, whilst the skin combines these two functions, and all of them give off water in large amounts. And there is a certain definite relationship between them in their actions for it has been observed that when anything occurs which prevents one acting the others begin to perform its function, as for instance, in some diseases of the kidney we find a great quantity of urea is contained in the sweat, so you see what a wonderful and important part of the subject this is, for anything that prevents the secretion of sweat necessarily throws more work on the lungs and kidneys. The accumulation of effete matters must take place unless the various excreting organs are performing their work for although they act reciprocally as it were, yet, when one organ is diseased the others cannot make up for it *in toto*. Therefore the healthy action of the skin should be kept up by cleanliness so that the sweat may not be retained. The clothing should not interfere with its action, it should therefore be of such a nature that it would absorb it when poured out so that it would not remain on the surface of the skin. This closes what I have to say with regard to the purifying action of the skin.

Now the other great function of the skin is that of the body temperature regulator. The body must be kept at a normal temperature in order to perform its duties efficiently and effectually, any deviation even though slight cannot take place for any length of time without seriously interfering with health. The normal temperature as shewn by the thermometer is 98·6 F. but it varies in certain parts of the body, being warmer in those places better supplied with blood, or in those places nearest to the heat-producing centres. The temperature varies only some hundreths to some tenths of a degree in people living in the far north such as Greenland and those whose abode is in the tropics. The temperature of the air has little effect on it as we are always about the same degree summer and winter, if in health. What is the source of heat in our bodies? This was for a long time a vexed question, but now I am happy to say by our more delicate physiological apparatus we have definitely been able to settle the question. Now it is found out that wherever chemical action, wherever tissue metabolism is taking place there the blood coming from the tissue is hotter than that entering it, and so the tissue is the heat-producing apparatus. So heat is virtually produced in every part of the body. The greatest sources of it are the muscles, for when in action chemical change is constantly taking place, and the glands, for in the liver (the largest gland of the body) the blood entering it is about one degree colder than that proceeding from that organ, so you see the heat in the body may be compared as if coming from various little stoves situated in different parts of the body. The muscles when at rest produce little or no heat, when in vigorous action they produce an immense amount of it, and so during exercise of them we get varying outbursts ot heat produced, and if it were not for the skin we should be experiencing during the day great variations of temperature which would be very dangerous. Now the chief function of the skin is the regulation of the temperature, and it has to do this in a double sense for it has to counterbalance those outbursts during exercise and also prevent the surrounding atmosphere from abstracting too much heat from the body, and clothing is intended to help the second process. How is this regulation effected? We all know that our bodies become red and moist when heated and that the cold atmosphere causes our hands to get white and dry; now the effects are produced by that beautiful mechanism—the nervous system—the stimulus of cold or hot air acts on some small nervous fibres in the region affected and a message is sent up to a central nervous centre which again sends back messages to the blood-vessels and glands in the neighbourhood to regulate them accordingly. This is called a reflex action. Now we will examine this a little more minutely and see how this affects the temperature. Suppose for instance the body in any particular part is subjected to heat of any kind the result of the message thus sent up would be a dilatation of the blood-vessels in the district and an increased activity in the sweat glands there, thus the part would become red and moist. As a result of this you get a large volume of blood brought to the surface and cooled and sent back again when it returns only to to be cooled again and this goes on until the temperature is sufficiently reduced. The other consequence that I mentioned was that the surface of the body becomes moist, due to increased action of the sweat glands. Now this moisture rapidly undergoes evaporation. Evaporation as you know has a powerfully cooling action, the moisture abstracting heat out of the body by becoming heated by the warm surface underneath and thus by these means heat also is lost. When this cooling process has proceeded far enough the vessels and glands again return to their normal state. So the skin has the power of regulating the amount of heat, which is constantly being lost by the body being surrounded by a medium having a lower temperature than itself. Now how is heat lost? There are four ways in which it may be, viz., (1) by radiation, (2) evaporation, (3) conduction, and (4) convection. Now let us look at each of these separately.

1. *Radiation.* The process by which heat is transmitted across an intervening space from one body to another is called Radiation. Our earth is heated by the sun by this process, the rays of heat passing through space and coming in contact with it, and there is this peculiarity about heat being radiated and that is that it may pass through a medium without heating it to any appreciable extent, and so when we light a fire on a cold morning it takes some time before we feel the room heated and in fact this does not happen until the walls become warm as they absorb the heat which is being radiated from the fire. It is by Radiation that we feel our hands get warm when we hold them in front of the fire. Radiation therefore is always going on as it must whilst bodies of different temperatures are near each other. Now what bearing has this on clothing? Well we can prevent Radiation by putting on clothes which will stop this heat from leaving our bodies.

2. *Evaporation.* When a liquid passes into the gaseous state it evaporates. Now, as I think I have already mentioned, in so doing heat is lost and also it extracts the heat from the surface with which it is in contact. You see by this the great use of perspiration, for as it is continually going on we are constantly losing heat from our bodies and whenever our skin becomes damp we are much colder although we often feel hotter, so it is very important that next to our skin we should wear some material that will absorb the perspiration in order that this cooling process shall not proceed too far otherwise it would lead to dangerous consequences.

3. *Conduction.* The process by which heat passes from hotter to colder parts of a body, or from one body to another in contact with it is called the conduction of heat. Heat flows more quickly through some substances than through others, or from one thing to another in contact with it. These substances through which it flows with greater facility are called better conductors. A bar of copper may be looked upon as a number of small particles in contact with each other, and if you placed one end of it in a fire the other would quickly get hot, the heat travelling from one particle to another very quickly, and in such quantity that you soon would not be able to touch it

without burning your hand, whilst a piece of wood can easily be held in the hand whilst the other end is burning because wood is such a bad conductor of heat. The brass handle of a door feels much colder than the panels because it is a much better conductor of heat and therefore conducts the heat out of your hand. You know that sheets feel much colder than blankets when you lie between them because the latter are bad conductors. Thus all materials with which we wish to use to keep ourselves warm should be bad conductors, and Nature uses as clothing for her progeny the worst of conductors, viz. wool and hair. The bad conductivity of wool is often made use of when we wish to prevent ice from melting, for then we cover it with a blanket.

4. *Convection.* Convection of heat is the process by which heat is transferred from one place to another by means of the motion of a body, generally a fluid, carrying heat with it. If a kettle be filled with water and placed on a fire the heat is conducted to the water, and thus it expands, becomes rarefied, and being lighter ascends, its place being taken by the colder and heavier water above and on all sides of it, and this goes on constantly causing a current which passes up in the centre and down the sides of the vessel, because the water nearest the outside is colder. The same thing happens with air, only it is more difficult to demonstrate. We are always losing heat from our bodies by convection, as for example, the air near our legs and between them and our trousers becomes heated by being in contact with our skin and thus it rises and its place is taken by fresh and colder air. If we be standing the heated air in rising comes in contact with our body higher up and does not abstract much heat from it, but when we lie down the case is different and we lose heat much more rapidly and this accounts for our taking cold much more readily when in the recumbent posture.

Now you see we lose heat from our bodies by all these four processes—by radiation into the surrounding atmosphere ; by evaporation through the agency of sweat ; by conduction through the soles of our feet being in contact with the ground, and by convection as I have just explained. The nervous system has the power of checking the loss for it acts on the blood-vessels and contracts them, thus allowing less blood to come to the surface of the body, and on the sweat glands by reducing the amount of perspiration and thus of the evaporation. The skin can manage to cope with a moderate loss of heat, but it has its limit, and therefore the idea, that putting a child out to play at the doorstep at all seasons and in all weathers and exposing it to winds is beneficial as it will harden (that is the usual word) the child, is a fallacy and is the cause of much disease, nay, not only disease but death. Of course it is quite possible that some children can be reared in this manner, but a great number get inflammation of the lungs and bronchitis, or rheumatic fever, and alas, the result is only too often well known.

Now as to the subject of what we should wear as clothing and Nature here supplies us with examples which we cannot do better than imitate. Of all clothing fur may be taken as the best example but we would not, if we could, wear the hair of an animal next our skin, and so instead we take the next best material of Nature namely, wool, and make it into garments for our use. If you have followed me you can see our clothing should be selected by a few simple rules. The main essentials are—we should have materials which are bad conductors, of which wool is a fine example, so as to prevent loss of heat in this manner. Secondly, the material should prevent the free circulation of air over our bodies as we are very liable to lose heat this way, and it should be such that winds cannot pierce it easily, and thirdly, we want a substance which absorbs rapidly so that the perspiration, if profuse, shall not remain long on the body. All these essentials are unobtainable in any single material as far as I know, so let us look at materials under these essential heads and compare them. As to conductors of heat, wool is the worst I know of, and it is therefore well fitted to keep the body warm, next to it comes silk, and next again cotton and linen, so in winter it is better to sleep between blankets and wear woollen clothing to keep oneself warm. Eider-down is the worst of all conductors and is extensively used for quilts for winter use. As to absorbers, here wool again stands pre-eminent and it also has this advantage that the absorbed materials rapidly evaporate from it. It is therefore wisely made use of in summer by athletes (in the shape of flannels) for out-door exercise, especially when it is violent. It is also very useful in winter as wraps when we leave heated buildings. Now as for materials which are impervious to winds, and here unfortunately wool is one of the worst although so good in other respects. Skin, in the shape of leather or kid (as used for gloves) is one of the best but here unfortunately you see they are good conductors and therefore their gain as shields from the wind is more than counterbalanced by their conducting powers. You all must have noticed how cold a pair of kid gloves are on a cold day, and may have wondered at it, and it is due to this fact that although they keep out the wind they are such splendid conductors of heat. From these few data you can easily select for yourselves the clothing most suitable for your case. If you are liable to sweat freely in your vocation, and especially if exposed to wind or draughts at the same time, then woollen materials are best. Some of you cannot wear wool next to the skin, especially if the latter be tender, as it is rather irritating, and to those my advice is to wear merino next it and flannel immediately external to this. If some of you, say, are in the tropics and want cool clothes then unquestionably cotton or linen materials are the best, but you must remember then that you are running the risk of chill from rapid evaporation when perspiring, and should guard against it as these materials do not absorb very readily. If we are exposed to piercing winds then leather or mackintosh is best, but you should not wear them constantly for a long time together unless you have a good thick layer of flannel underneath in order that the perspiration may be absorbed. In passing it is just as well to mention that there is great benefit to be obtained from an additional garment being used in cold weather, for you not only prevent so much loss of heat by the use of a bad conductor, but there is a layer of air between the additional garment and that underneath it which becomes heated and helps to cause a less amount of heat from being lost from our bodies. There is another thing which affects the value of our clothing and I would like to say a few words upon it, it is the colour of them. This is not of so much importance in this country, but it is to those who live in tropical regions as we are not *here* often subjected to the hot and bright rays of light which come from the sun as they are who live near the equator. Colour affects the loss and gain of heat by radiation and that is why this is so, and when we are under the influence of the powerful rays of Master Sol we appreciate the value of the colour of our clothes. Dark clothes are by far and away warmer than white ones, for the former absorb the rays of heat, and they themselves become quickly heated whilst the latter reflect the rays from them and thus remain cool. So you see the *rationale* and advantage of using light coloured fabrics in summer and dark ones in winter. The different colours may be arranged in the following order beginning with black as the warmest, next comes blue, then red, then yellow, then grey, and finishing with white the coldest. There is still one more point bearing on clothing to which I would like to refer and that is the effect of water upon it, for we have to consider everything in a subject like this, when we are trying to lay down rules for our guidance in the choice of clothing. In all porous fabrics water causes them to ventilate less readily and to conduct more rapidly. Textures whose pores are numerous and comparatively large do not become affected with water so rapidly as those of the opposite type. Linen and silk soon get their pores filled by wet, whereas flannel takes a long time before it does so, and it is therefore plain that flannel is better for wet seasons. Having mentioned some of their chief practical points of our subject, which no doubt some of you knew before, let us apply them to some matters of common occurrence. Let us refer to the popular phrase known as 'catching cold.' It is evident that when the blood-vessels all over the body are evenly distended with blood there is no over-tension in any particular spot, but should from any cause the vessels in any particular part become dilated then the blood rushes there, as it were, and the part becomes red and congested, and this is particularly shewn in what is known as a 'blood-shot eye' or in other words 'catching a cold in the eye,' for here the blood-vessels which were unobservable in the first place become so enlarged that they may be seen standing out as fine threads which ramify all over the surface of the eye. It is also equally clear that if anyone whose vascular system is evenly balanced be exposed to a cold current of air over a large area of his body the blood-vessels on the surface of the skin become contracted in a manner I have described, and the blood contained in them is forced into the organs of the body more internal thus causing extra pressure to be thrown on them and an overflow takes place as it were, giving rise to disease in them. The organ which becomes affected naturally is the one weakest at the time for it is an old saying that 'the weakest goes to the wall.' In one case it might be the bronchi, and bronchitis follows, in another the smaller alveoli of the lung and we get inflammation of the lung or Pneumonia, yet in another it might be the kidneys, and we get Inflammatory Bright's disease, and still again it may be the vessels of the nose and eyes and we get Influenza or Catarrh of the head. Everyone has some particular area which is weakest and this differs in nearly every case, very often this special area has descended from the forefathers. You all must have been struck with the fact that if two persons are exposed to the same atmospheric changes the one will perhaps get bronchitis or inflammation of the lungs whilst the other may get a cold in the head or escape altogether. How is it we often catch cold when we cannot possibly find or trace any particular time on which we felt a chill? Why is it we catch cold more frequently in damp, dirty weather than when it is cold and dry and the temperature is much lower? The truth is that a factor, and a very important one, is omitted in our consideration of this, and that is the state of our health at the time. The low temperature of a sharp frost and clear sky is far less dangerous to health than walking home from an ill-ventilated and over-crowded room on a damp, muggy night, and there is great danger in being exposed to a draught in a hot and badly ventilated room. Let us follow what happens when you enter a room where there is a crowded meeting and the dangers on leaving it. Suppose you are perfectly healthy and go to a crowded room without any overcoat, what is likely to happen? You enter the room and sit down surrounded by males and females. Now what changes take place? You are now in a warm and fairly moist atmosphere, nearly perfectly still, and gradually you get warmer. Now what is the cause of this increase of warmth? Is it because your body is producing more heat? No, certainly not, quite the reverse, for as you are doing no exercise that source of heat is destroyed, it is because you are losing less heat. Let us consider and compare the various ways of loss of heat under the two conditions. First let us take radiation. When outside you were surrounded by a cold medium much colder than yourself, so much of your heat was being radiated and thus lost, but when inside the room this source of loss is practically cut off, the temperature being only a few degrees lower than that of yourself. Now let us look at convection. Outside, the air being in movement deprived you of a lot of heat, but inside the air is more or less perfectly still and so this source is also cut off. Now what about evaporation? The air outside is much drier and colder than that within the room, therefore less amount of moisture is given off by the lungs and the evaporation from the skin is greatly reduced. As regards conduction it need not trouble us as very little heat is lost by this way at any time. You see that the loss of heat is lessened by all the different ways, you therefore get warmer and at last if it be very crowded you break out into a profuse perspiration and you may even suffer from headache or you may actually faint by the accumulation of carbonic acid gas (a poisonous gas given off by expiration) and weakness of the heart caused by its being over burdened. This goes on until the time arrives for your departure and what a complete change here takes place, what a complete reversal of all that has been going on previously. You go out of a warm room—your clothes and skin damp—into the cold dry atmosphere and your system then has to stop suddenly all that it has been doing and try to prevent as little loss of heat as possible, that is passing from one extreme to the other. As you go into the air your warm, damp clothes radiate heat very quickly by convection, you also lose heat as the air is not now still, for you are moving through space, and evaporation also proceeds apace as you are so much damper, and so as all your pores were open before, now they have to close suddenly and the rapid loss of heat causes you to feel chilly, your nerves cause the blood-vessels to contract and send the blood into the internal organs—as I have explained—with the result that you get inflammation or congestion of the weakest organ at the time. Of course this may be prevented in one or two ways. If you keep up an extra supply of heat by exercise to compensate the extra loss, then no harm would befall you, but better than this is to put on an extra covering in the shape of a non-conductor when you are about to leave the room and prevent such a rapid loss of heat from your body. Those who were most liable to danger would be those who wore cotton, linen, or silk next their skins as they are such good conductors compared with flannel. Now I should like to refer to the clothing of children and in the first place I should like to point out that they are far more delicate plants than adults and therefore require more care as regards their clothing, and they are also more sensible to the influence of heat and cold, partly, no doubt, owing to their thinner *cuticle* and more active nervous systems. I have already referred to the uncivilized idea of hardening, and so need say nothing more about it as the process is nothing short of a mode of killing the weakly and upholding the doctrine of the "survival of the fittest." I only trust that now that you understand this hardening process more perfectly than you did before you heard this lecture, you will take care that you do not subject your children to it, and thus cause them an immense amount of suffering. There is a stage of childhood when the dress is very unscientific and fraught with unknown danger, and that is from the "shortening period." How often do we see the little creatures with legs, arms and chests quite bare indoors in the winter and even out of doors in the summer time? You see by this there is a great loss of heat and we are unable to calculate the amount of disease caused by it. I only trust—aye plead—that you will see that such be not the case with your little ones, that at least you cover up their chests, and if possible their legs, and pray do not let fashion hinder you in this; and by so doing you will save the doctor's bill and will not run the risk of sacrificing your childrens' lives. This especially refers to the period immediately following the time of shortening. The third practical point to which I would refer is the washing of clothing. It is a prevalent idea that blankets and woollen under-clothing requires less washing than sheets and linen, but the reverse is really the case, for blankets absorb more perspiration than sheets, and they also collect more of the epidermic scales which are constantly being shed. It is the same with flannel worn next the skin—it absorbs a far larger amount of sweat than cotton and this dries and leaves the solid residue behind. The same applies to light and dark coloured fabrics, the latter requiring washing oftenest, although we know that such is not often done, for people generally wear coloured flannel for a longer period than white, and the latter longer than linen.

I should like in the next place to refer to the question of bedding, and especially that of sleeping in strange beds. The power of absorption of flannel over linen here comes into play. Should we be in an hotel and have to sleep the night there we should always be particular as to the bedding. Should there be a fire in the room it is always advisable to take out the sheets and air them before we go to bed. Suppose such cannot be done and we are suspicious of the dampness of the bed, it is well for us to take out the sheets altogether and lie between the blankets, because supposing both sheets and blankets be exposed to the same atmospheric conditions the sheets would become saturated with moisture a long time before the blankets, and thus the blankets may be almost dry whilst the sheets are quite wet, and moisture absorbs the heat out of our body very quickly, so we should avoid it. This leads me on to another question, viz.: what is the danger which arises from wearing wet clothes and whence does it arise? Its cause is not far to seek, for damp clothing refuses to absorb the perspiration and therefore this excreting function is interfered with, and thus more work is thrown on the lungs and kidneys, and there is also the cause just mentioned of water abstracting heat from the body very rapidly and causing a great fall in the temperature. Just a few words in conclusion as to the most suitable kind of underclothing for a climate so varying as ours. Now there are three rules by which we should be guided, (1) the state of the atmosphere and the season of the year; (2) the amount of bodily exercise and age of the wearer; (3) the weight of the garments. 1.—If the weather be hot and dry in the summer, flannel next the skin and clothing light in weight and colour is most suitable, but during a damp summer thicker and darker stuff should be substituted for the outside clothing. In winter we should wear heavy flannels next the skin and externally dark thick materials. For the changes of temperature from day to day we should use an overcoat summer and winter, thin for summer and thick for winter. 2.—The amount of exercise must necessarily guide us, for a hard-working man needs less clothes than he who sits at his desk all day, but the former should guard against cold after work by wearing extra clothes when his labour is over. The same applies to the man driving, he requires more than the man who walks. As regards age—the old and young have specially to be protected. 3.—Clothing should be light in weight and hang from the shoulders and should not interfere with the motion of the body.

In conclusion I trust that the few remarks I have made on this subject will not be without its fruit, and that although many of them are common-place enough, yet the impressing of them on your memories and the showing to you their practical and hygienic applications will I hope be beneficial to you, and I sincerely trust that it may be the means of preventing much suffering among you and your children in particular, for the object of these lectures is to prevent disease, and should any remarks that have fallen from my lips be the means of attaining that end the time I have spent here to-night will have been more than amply repaid.

SLEEP AND REST.

"*There lay Argyle on the bed, sleeping in his irons the placid sleep of infancy.*"
MAC. H.E. I, 565.

"*Thine anguish will not let thee sleep.*"
TENNYSON—(Two Voices.)

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SLEEP AND REST.

THE subject that I have chosen for our consideration this evening is one that some may consider outside the pale of lectures having a practical relation to Health, whilst others may think that it partakes too much of the scientific side, but when we consider that upon sleep and rest depends our very existence, for without them some time or another we cannot live, and also, that our health in the main is entirely responsible to them for its condition, then I think we shall realize the positions that they should hold in a series of lectures designed for improving the health of a community. Although sleep is a matter which is of every day occurrence and very familiar to us all, yet, I do not think we let it claim our attention often enough, and it is mainly for this reason that I have chosen it for a subject. Sleep, although so common and simple and easy, may seem to some of you a very difficult subject to explain, and when I tell you that scientific men cannot properly define it, it may seem strange. When we consider it—sleep is one of the marvels connected with our very existence; just consider for a moment that by the condition of being awake the whole of the affairs of the world are carried on. Just look at the bustle and noise in a great city, some are engaged in muscular exercise of various degrees, according to their different pursuits, whilst others are sitting at their desks calculating their varying fortunes or the fortunes of those for whom they work, and others again may be working out some abstruse problems, all these being but the combination of our many senses. Compare this with the stillness of the night when sleep has seized a number of its victims, and do we not see a mighty change, a great contrast, and this change only means that the operations of the mind are ceased and at rest, sensation less acute, will completely gone. Sleep when sound gives rest to the entire frame. When we are asleep all is oblivion. The eyelids are shut, the hearing stopped, taste and smell in abeyance, we know nothing, we remember nothing, we wish for nothing, we think of nothing, it is the mimicry of death. But although the whole body is at rest, the heart still propels its life-giving stream through the various channels so that the different organs are enabled to carry on their several functions, and the brain able to repair its worn out condition. The lungs automatically contract and expand so that the blood can receive the oxygen necessary for the repair of the tissues. All animals, with a highly developed nervous apparatus require sleep, or brain rest in other words, and even plants have actions which suggest a sleeping condition, buds and flowers close at night to open again in the morning. Sleep is not a state of mind exactly but a succession of states into which we pass and in which all activity is temporarily stopped. All animals and plants have periods or seasons of activity followed by repose during which repair goes on. Take a tree for example, it dies, as we say, in winter time, which is analagous to sleep, but only to grow again with renewed activity in the spring. During the time it was dead it was repairing the waste that had taken place ; it is the same with animals—where there is life there is work, where work there must be waste, and where there is waste there is a necessity for repair. We can easily demonstrate this for ourselves : let us take a dumb-bell and hold it out at arm's length, after a time a period arrives when the arm must drop to the side because the muscles in action require a certain time to repair the waste caused by their use. The heavier the weight the more the waste and therefore the time at which repair becomes necessary arrives much sooner. At first sight there seems to be an exception to the rule that where there is work there is necessity for repair. In the case of the heart, for its action never ceases, and *à priori* one would think that it never rests, and the question naturally arises, how is it that the heart repairs its waste ? The answer is not far to seek for the heart does not go on without cessation from one year's end to another. It has a short interval of rest at the end of every period of work. The heart contracts with every beat, as you are well aware, but at the end of the beat there is a pause before it begins its action afresh, and during this interval it rests sufficiently long enough to repair the waste. The length of this pause has been estimated by physiologists to be about 4-5ths of a second, by no means an inconsiderable space of time if you consider the length of the time occupied by the beat or contraction. It has been calculated that if the length of time of these pauses during 24 hours were added together they would amount to about seven or eight hours, which is curiously enough about the amount of allowance of sleep necessary for a healthy man, so you see the heart in reality rests a great deal. These short periods of rest for the heart are a very wise provision of Nature, and in fact it is the only one compatible with life. But although indispensable to the heart it would not do for those organs requiring longer periods of repose and I am sure we should find it very inconvenient if we had to drop to sleep for 4-5ths of a second from time to time. The necessity for sleep is at once apparent, for our tissues destroy themselves by their actions, and were it not for the periodical occurrence of rest they would gradually wear themselves out. The importance of this shows itself in the fact that we sleep for about one-third of our lives. During sleep the reparatory organs are at work, the heart goes on beating, the digestive organs perform their duty and the lungs continue their action. Now if we at once grasp the fact that it is the necessity for repair that compels sleep we see that the latter must be periodical in its action, or in other words, that our tendency to fall asleep must be greatest at certain marked intervals of time. The quality or degree of sleep varies at different times whilst we are asleep and we are fluctuating between the two extremes during the whole of our period of repose. Sleep does not always either begin or end with drowsiness or torpor. As regards the oncoming of sleep we cannot lay down any precise statements, for we can pass from being wide awake into the deepest torpor in 20 seconds and out of it again in the same time, in fact you can pass from one extreme to the other in the smallest appreciable space of time. Now as to what is the cause of sleep? This is a question which has been discussed for a long time by physiologists and they cannot positively answer it even now. The great predisposing cause is no doubt the repair of the exhausted energies, but what is the direct cause? We have seen that the state of sleep is in a constant state of fluctuation and so whatever the cause it cannot be a constant one, it must be one of varying intensity. My own opinion as to its direct cause is that it is *anœmia* or bloodlessness of the brain, and there are certain facts which uphold this view. You see it would be quite in accordance with the condition I have mentioned for the blood supply to any part of the body is never perfectly constant including the brain. I have not time to enter into a discussion of the various facts that have been adduced as time will not permit, and I should have to delve into subjects too scientific for a lecture such as this. I should like to mention one fact in support of this view. Surgeons have been fortunate enough to see the brain when portions of the skull have been removed by accident or otherwise and they have seen that during sleep the brain becomes much smaller and paler and that on waking it regains its reddish colour, hence it is only natural to ascribe as the cause of sleep the diminished supply of blood to the brain, but although this is the generally accepted theory we should not jump too suddenly at conclusions because paleness and diminution of the size of the brain occur during sleep, yet, it may be nevertheless an effect and not the cause of sleep, for during the state of somnolence all the functional activity of the brain ceases, and therefore the blood supply to the organ would of necessity be lessened. Supposing that it were possible for you all to see the brain during the onset and course of the sleeping state, you would see that as the drowsiness began to appear the brain would lose its reddish-pink colour, gradually become paler and paler, its size would in proportion become lessened and when sleep had set in the maximum of the pallor and the minimum of size would then have been reached. Then if the person were suddenly aroused from his sleep the brain would become redder and redder until it would resume its former appearance and the circulation would be seen to become very rapid again. There are some who support the theory that sleep is induced merely by weariness of the organ, as it were, and it takes place then when the circumstances favouring its production are present. But if this be the cause how can you account for some men such as Napoleon the First being able to go to sleep at any moment? This could not be from his being able from a great effort of will to completely tire out the brain suddenly by a sort of explosive effort. No, we must look for some other cause; and the theory accepted by others and the one I have mentioned seems to me to be the only tangible one. Here we can account for men being able suddenly to command sleep. There are certain nervous centres in the brain which are in communication with the muscular fibres surrounding an artery and forming one of its coats, and when any stimulus is sent from them, the calibre of the vessels is lessened, due to a contraction of the muscular fibres just mentioned, thereby the blood supply to any organ in connection with the vessels may be greatly diminished. So men like Napoleon have the power of willing these centres to act and thus cause less blood to enter the brain and sleep ensues. We know that some men can exercise their will over some nervous centres in the brain, for a man was able to stop his heart beating and set it going again at any time he wished by a mere effort of his will, but unfortunately for the man in question he did it once too often for he was unable to start it beating with the result that he was buried within a week.

Although the direct cause of sleep is somewhat doubtful there are certain causes which predispose to its occurrence. The chief predisposing cause of sleep is a negative one, viz., the absence of all stimuli to the various senses. Darkness or a very dim light, no noise or a monotonous sound, a comfortable bed—neither too hot nor too cold, an easy position, the mind in a passive state, absence of anxiety or trouble all contribute very markedly as predisposing causes. It may seem strange to some how monotonous sounds help to bring about sleep. The truth lies in the fact that the repetition of stimuli of equal degree produces a level uniformity of impression which is in reality equal to no impression at all, for the centre in the brain becomes accustomed to it, consciousness is not called into action. A moderate amount of bodily fatigue is also conducive to sleep—you all must be aware of this for when you have been taking an exercise to any extent, and especially if it be in the open air, you feel quite drowsy afterwards. The same is the case with mental work. But should the exercise of body or mind be excessive the opposite effect is obtained and sleep, "tired Nature's sweet restorer," is driven away. Of course if excessive exhaustion takes place, as was the case in the olden times when the tortures of the prisons then in force took all the energy out of the poor victims, sleep ensues, and indeed there are cases recorded when the poor creatures actually went to sleep on the rack. And let me quote to you the words of Shakespeare, from Henry IV, and you will see what a true picture he there draws.

"How many thousand of my poorest subjects
Are at this hour asleep!—Sleep, gentle sleep,
Nature's soft nurse, how have I frighted thee,
That thou no more wilt weigh my eyelids down,
And steep my senses in forgetfulness?
Why rather, sleep, liest thou in smoky cribs,
Upon uneasy pallets stretching thee,
And hush'd with buzzing night-flies to thy slumber,
Than in the perfum'd chambers of the great,
Under the canopies of costly state,
And lull'd with sounds of sweetest melody?
O! thou dull god, why liest thou with the vile,
In loathsome beds, and leav'st the kingly couch,
A watch-case, or a common 'larum-bell?
Wilt thou upon the high and giddy mast
Seal up the ship-boy's eyes and rock his brains
In cradle of the rude imperious surge;
And in the visitation of the winds,
Who take the ruffian billows by the top,
Curling their monstrous heads, and hanging them
With deaf'ning clamours in the slippery clouds,
That, with the hurly, death itself awakes?
Canst thou, O partial sleep! give thy repose
To the wet sea-boy in an hour so rude;
And, in the calmest and most stillest night,
With all appliances and means to boot,
Deny it to King? Then, happy low, lie down!
Uneasy lies the head that wears a crown."

Great anxiety to bring on sleep generally has the opposite action, for the mind then becomes too active. People as a rule go to sleep when there is absolute quietude around but this to a great extent depends on habit, for those who dwell in large towns and whose houses are in the busiest thoroughfares go to sleep quite as easily as the country dwellers. But should a town dweller change his residence into the country then he finds that for a time the stillness seems to disturb him, and his sleep is with difficulty obtained. The opposite also holds true—if a man living in the country comes to stay in the busy part of the town every single noise catches his ear and renders sleep anything but an easy natural function. It is very difficult to explain how sleep comes upon us, although we are all so familiar with it. The senses seem one by one to fade away, they seem to dissolve by an insidious process, but thoughts keep flashing through our minds quite uncontrolled by the will, and the mind becomes chaos. Many are of opinion that when we are quite asleep all thoughts stop and we are completely unconscious and that dreams, which are thoughts, only occur as we are gradually and insensibly passing into the state of sleep ; whilst others assert that dreams continually take place and that those which are present when we are in deep sleep are not remembered, but only those which occur when sleep is light ; but you see how difficult these problems are to solve. It seems to me that they can only be conjectures and will never be more than that. Any occurrence that has taken place during the day may form a part of our dreams and it may be mixed up with all sorts of incongruous ideas that flash through the mind when the influence of the will has been removed. It is strange to note how various circumstances which are in no way related to each other, become blended. They seem then to be real and we do not realize their absurdity until we wake. There is this peculiarity about dreaming—that the brain though active has no communication with the external world—the five gateways of knowledge are completely cut off. But in spite of this we imagine we see things as vividly, if not more so, as if they were realities. Images, that only as a rule could be produced by external objects, become actually created in our minds, we actually see things and hear sounds. It is quite possible to distinguish between dreaming and imagining. We can fancy in our mind the image of an absent friend, but should that friend suddenly enter the room we find out that we have drawn in our mind a different picture to that of the person who thus suddenly enters into our presence. The dreamer is different to this, the picture is more deeply and firmly imprinted on his consciousness than the shadowy picture of his imagination. The picture is not only as vivid but more so than if it were caused by an object. Who of you, that has read much, does not know of innumerable instances of the vividity of dream-pictures? Dr. James Gregory dreamt that he felt the hot crater of Mount Etna beneath his feet when he went to bed one night with a warm bottle to them. Burke, who was associated with Hare in the long list of Edinburgh murders, the latter who had turned Queen's evidence, had his fate revealed to him months before he was arrested and convicted. He had seen in his dreams the frenzied mob looking fiercely up at him when he was on the gibbet. There is also the peculiarity in dreams of our ability to expand space and time, we know how we have lived a whole life time, or even two or three of them, in a night; we know how we have travelled around the world in a few hours, visiting the various Capitals and seeing all the sights, the whole train of thoughts passing through our minds at lightning speed and leaving marked impressions on them. Now is the brain in a constant state of activity during sleep? The answer to this seems to be a negative one in the case of a dreamless sleep, but an affirmative one when dreams are present. This question has been very rife for many generations and as yet it has not been able to be definitely solved. We have been able to subject the brain of a sleeper to be exposed to our view and have seen the changes that have taken place in it when dream-pictures are floating past the suspended consciousness. When a portion of the skull has been removed by the surgeon in the operation of "trephining," or "trepanning," as it is sometimes called, we have been able to see what has been taking place in the brain substance. It has been seen that when sleep is dreamless the brain has been in a state of great pallor—in a condition like that which I have already described, during the sleeping state. But when the sleep is disturbed by dreams the brain becomes red and congested, similar to that which occurs in the waking state, only not to so great a degree. Now what must we infer from these facts? The brain becomes enlarged during dreams and the congestion is always present whether the dreamer recollects the dream or not, in a word we may say that this enlargement and congestion is an invariable sign of dreaming. Whether it be the cause or not of dreaming I should not like to say. So this is entirely antagonistic to some theories, such as Kant's, who said that when we ceased to dream, we ceased to live; or to others who state that the human mind never sleeps, that is, it never stops working, and that it is ever dreaming although we cannot recall our dreams when aroused. What can we say as to the cause of dreams? Well, the exciting causes may be classed under two heads. (1) Peripheral and (2) Central Stimulations. The Peripheral means in other words, sensations arising on the surface or superficial parts of the body which excite vibrations in the central nervous system. These are easily accounted for by alterations in the pressure of the clothes and the temperature, the various muscular movements and the different positions we assume giving rise to comfort or discomfort, also various conditions of the stomach, liver, etc. But the central stimuli are not easily so explained. That certain movements in collections of cells in the nervous system must excite dreams seem very probable, because things that have been imprinted on the mind one day may produce a dream picture a month or more afterwards, and this quite independent of external causes. As yet we have not been able to assign any cause to account for the sequence of dreams why they are chaotic at one time, why they follow one another in regular order at another, and the various theories that have been put forward to account for it would take me too long to describe and take me into the region of metaphysics.

The effect of a heavy, and especially of an indigestable supper is well known, and how it often produces dreams of the most horrible description—called night-mare. Various articles of diet taken before going to bed are apt to cause them, as for example, cheese, pastry, cucumber and a host of others only too well known. These probably excite dreams by stimulating the nerves of the stomach too severely at a time when they require to be quiet. Although these several agencies are likely to disturb your sleep I am sorry I cannot give you a recipe wherewith to produce the opposite effect, which shall be infallible, otherwise I should be able to turn the hours of sleep of the wretched and joyless homes into the happiest hours of their lives. Now the body remains perfectly still as a rule when the sleep is deep but in the lighter slumbers movements of the limbs take place and the person may even turn from one side to the other without as much as waking. There is a peculiar condition of light sleep when the person can hear questions addressed to him and even be able to give broken answers. There is an old trick made use of often—dipping the hand in water in order to bring the person out of a profound into a much lighter sleep, this is brought about because the sensation is not sufficiently strong to completely arouse the person, but only intense enough to bring the brain of the sleeper into the condition of light sleep. Some robbers have made use of this in order to obtain possession of any valuables that may be underneath their victims, an instance of which was recorded by the notorious burglar, Peace (whom you remember was at last hanged for murder in connection with his robberies). He said, that once he entered the bedroom of someone whom he was about to rob and after taking many things more or less valuable, he looked around for the watch but could not find it anywhere. The idea entered his head that it was under the sleeper's pillow (a not uncommon place), he paused for a moment and thought how he would be able to extract it, at length he set to work. He tickled the face of the sleeper who turned over on the opposite side and he was then enabled to put his hand underneath the pillow and secure the coveted object. It is said that the Dacoits or Indian professional robbers adopt a similar plan. In that country, as you are no doubt aware, the people sleep on mattresses placed on the ground ; the thief tickles some part of the sleeper's person until he moves a little away, this is followed by a tickle in another part which moves, and this process is carried on until the body of the sleeper moves off the mattress altogether ; the thief then triumphantly carries off his booty. The value of sleep as I have already mentioned is for rest, or in other words repair. All actions, whether they be of mind or body, cause waste, and waste necessitates repair, and without sleep, without rest, which must be periodical, our powers would gradually become wasted and fail altogether. Hence we need sleep and rest. Rest for the muscles in order that they may repair themselves, for the sense of their exhaustion tells us that work has outran repair, and sleep, or rest for the brain, is necessary that it may recuperate itself, not that the brain does not undergo repair during the day, for there is evidence to show that such is the case ; but there is no doubt that its repair takes place to a much larger extent during repose.

Now as to the value of sleep and the practical bearings as regards ourselves. I have already pointed out that sleep varies in intensity, that at one time it is very light whilst at another it is very heavy. The degree of its depth has been tried to be measured by the loudness of a noise required to arouse the sleeper. It is found that sleep rapidly increases at first reaching its maximum, about one hour after its onset, (hence the popular idea of the value of what is called the first sleep, that before midnight being thought to be of twice or even four times as much worth as that afterwards) and after that it gradually diminishes, at first more rapidly but afterwards slower and slower. Most sleep is required in infancy and old age and the least during the heyday of life. During the first three weeks a baby will sleep nearly the whole day and night, only waking up when it is washed or when Nature compels it to take nourishment. After a time this state becomes altered, the duration of sleep at night becoming longer whilst that of the day shortens. At the end of about twelve months it will take twelve hours sleep at night only waking once or twice to have nourishment, and during the day it will sleep when taken out of doors from a cause already referred to in my lecture, and will have a good sleep of two or three hours in the middle of the day. This mid-day rest is of great benefit to children, and on no account should it be dispensed with. It is good for the child if it keeps this up until about its third year. No doubt the cause of this length of sleep in an infant is to be found in the rapid growth of the brain, as during growth more is required than that necessary for the wear and tear. As we get older this rate of growth becomes lessened and an adult only requires from eight to nine hours of sleep wherewith to repair the waste that takes place during the day. In childhood there is a far greater amount of exercise taken (and it must necessarily be so in order that development should proceed favourably) and the muscles are therefore in a state of greater activity. The mind also partakes of this activity as you all know and therefore most rest is needed at this period than in later life. The man who employs his time by intellectual work during the day needs less sleep than the one who earns his daily bread by the sweat of his brow, for the former can periodically rest his brain during the day by turning his mind and attention to some other occupation, whereas the latter is continually in a state of unrest when at his tools. Children at school therefore, that is if not overworked, need no more sleep than at other times, in fact, as a rule they require far more rest during their holidays as then their muscular apparatus is called upon for more work and therefore fatigue comes upon them faster. Prolonged muscular effort causes sleep, as I have pointed out already, by bringing on waste of tissue faster, but prolonged and severe mental effort has the opposite effect as it drives sleep away. The explanation is to be found in that the brain becomes more congested from it, and you know that this must be toned down as also its cause before sleep can overtake one. This has a practical bearing, for it teaches us that all active work of the brain should be given up for some time before going to bed and its place taken by any light amusement, therefore the child should not do its lessons right up to the moment of its going to bed, it should stop its work at least one hour before. The same may be said of the man of intellectual habits. He should cease from solving his various problems sometime before he places himself in the hands of Morpheus. There is another point which should be attended to which I have already pointed out as predisposing to sleep, and that is comfort in bed. The room should be well ventilated although not draughty, and this is a point not often looked after. A great number of medical men are of opinion that the tops of the windows should be put down a little in order that a free supply of fresh air should be obtained, but in a climate such as ours I think this is a doubtful advantage, it may do very well for some no doubt, but in other cases I am afraid it is rather risky. If you pay attention to the matter of draught that is likely to arise from such a proceeding and see that such does not occur then there is no danger of its interfering with your health, in fact, it would be of great benefit to you. The temperature of a room where you sleep is also of great importance, it should be of a medium degree, neither too hot nor too cold, and here you have another risk of leaving your window open all night, for in the cold winter time the temperature of your room is apt to get too low. So you see we may say that during the summer we might sleep with the window open during the night, provided there be no draught, but in the winter it is expedient to have it shut up or only open to the slightest extent, about an inch or so.

I think there is another matter on which I should like to say a word, and that is concerning night-work for those who are attending school. This, in my opinion, is a question that those in authority should deal with, for when you consider that a child has been working and playing all the day and that by the time it comes evening its vital powers are at their lowest as the waste has been proceeding apace during the while and then at this particular time the child is called upon to do often the severest mental work taxing its brain to its utmost, you will see the folly of it. This accounts for the child often being unable to do its work as well at night time and many of you have heard of instances where children cannot remember their work over night, and it is not to be wondered at when you consider the state the brain is in when it is called upon to do the lessons. To the fatigue of mind and body is added the anxiety of doing work, the fear of losing position in class and perhaps punishment. These often cause sleep to be driven away and it is to this that we are sometimes called upon to treat brain mischief on account of over-work as it is often called, but this is in reality a misnomer for you see it is generally on account of want of sleep, not due to overwork, but due to the bad arrangement of the times of working. You know you must have a sound mind in a sound body (*mens sana in corpore sano*) in order that education may proceed favourably, and it seems as if this is not generally attended to in the schemes of those who rule the educational department of our lives. Children may be allowed to sleep as long as they want, as a rule, which is generally somewhat longer in winter than in summer, but should their sleep be very long or very short, you may depend upon it, that they are out of health and a cause should be sought for directly. I will just give you a table of the quantity of sleep considered necessary at different periods of our lives as you might like to know it, but you see we cannot lay down any fast rule, as the amount is liable to fluctuation according to our employment, etc., and so my table will be the average.

TABLE OF SLEEP.

4	years	12	hours.
7	„	11	„
9	„	10½	„
14	„	10	„
17	„	9½	„
21	„	9	„
28	„	8	„

In reference to adults, they may be allowed to trust to themselves as to the amount necessary, for they can generally tell the amount required, but there is one word of warning I would give, for I feel certain that in the bustle and competition of life where so many things are crowded into the 24 hours, where amusement and toil, pleasure and labour all have to take their share, that the amount of sleep taken must often be too small and therefore you should guard against it. Now we have taken a fair survey of the causes and duration of sleep so let us turn our attention a few moments to wakefulness or *insomnia*. What are the causes of it? Why cannot we sleep? I have mentioned some of the predisposing causes of sleep and so in a great many instances you will be able to find out the cause of your *insomnia*. I have mentioned that worry, excitement, hard mental work, anxiety in your speculations and undertakings, mental exercise immediately preceeding rest all tend to keep you awake and each of these can be dealt with by yourselves, every one doing his best to remove the cause. I have also mentioned the subject of indigestion, the irritation caused by it keeping you awake, so you should not take a very heavy meal going to bed, and you should abstain from those things such as pastry, etc., which I have mentioned and which you all know are harder of digestion than others of the several articles of diet. There are some things which cause wakefulness and therefore they should not be indulged in for some time prior to bed-time, the chief of which are tea, coffee and cocoa, and of all the worst is green tea. In some the idiosyncrasy is so marked that they cannot sleep if they have partaken of any of these beverages even late in the afternoon. This peculiar action of these articles of diet is often made use of by people who have to work hard, that is intellectually, at night, in order to prevent their falling asleep. I have seen instances of it myself and I believe I also have made use of them when working up for some of my professional examinations which, as you know, tax your intellectual powers to the utmost. Their action is no doubt due to their stimulation of the brain, and there is evidence to show that a strong cup of tea or coffee does excite the ideational centres in the brain and you therefore have a greater congestion of it, due to the increased activity, which as you know is antagonistic to the qualities necessary for sleep. As to the use of the hot glass of grog going to bed, a great number would derive as much benefit from a hot glass of water, and as I am sure that it would not do any of those any harm who indulge in their evening glass, they would do well to give it a trial, and many would find that sleep was nearly as easily brought on by its use as when mixed with alcohol. The action of the glass of water, or water plus alcohol, is due to a dilatation of the vessels of the stomach which causes blood to be drawn from the head, and thus the production of sleep is favoured. You have all heard of various ingenious methods adopted by some to induce sleep, such as counting over and over again, or repeating any word or sentence, of counting imaginary sheep jumping over a place; all these are of use by bringing the mind into a state of quietude, the monotony acting on the over active brain. In the last place there are those cases of sleeplessness where the person is unable to sleep night after night, and in all of these the advice of a doctor should be sought, but I am sorry to say that such is not always the case, for some doctor themselves and indulge in soporifics and opiates, often doing themselves a great deal of harm, for they are using drugs whose action they do not properly understand, and in many instances their *insomnia* could be cured without resorting to opiates by means of some simple remedy. Many do not appreciate that they are dealing with drugs that are poisonous, and therefore every now and then we read of deaths from an overdose of some of them, and there is also another thing which they do not reckon upon and that is that after a time they find they cannot do without their *narcotic* and they become habitually addicted to its use. I have endeavoured to-night to bring under your notice the chief and latest theories regarding the state of sleep, many of them no doubt are common place enough and well known to you all, whilst others may be new to you and I hope they may have proved interesting, as I trust they may make you think of this marvellous state of our lives. I also venture to hope that you will agree with me, that in selecting sleep as the lecture for to-night, I have taken for a subject that which has a very practical bearing on health, and one that should have a place in addresses intended for the benefit of the health of a community.

COLDS. AND THEIR CONSEQUENCES.

"*His red colour hath forsook his cheeks.*"

RICH. III, ii., i.

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COLDS AND THEIR CONSEQUENCES.

I HAVE chosen to-night for my subject the most common-place disease known to you all, namely, a Cold. I shall endeavour to point out to you the result of neglecting such a complaint, trifling as it may seem, so that having had the dangers of such a course brought before your notice you may try in the first place not to catch a chill or cold, and in the second, that provided you have been unfortunate enough to have taken cold, you will attempt to get rid of it as soon as possible, or at any rate do nothing that may make it worse and thus perhaps imperil your life. As medical men we are brought face to face with the fact that a great number of serious diseases which come under our notice are the result either of a chill or cold, neglect of them, or a repetition of slight attacks of cold. The immense importance of a subject like this must be apparent to all of you for you know how numerous chest complaints are, and when you remember that consumption often has its origin in a cold and that there are various incurable diseases attributable to the same cause, its dual importance is brought to light. If you take the trouble to look at the weekly return of deaths made by the Medical Officer of Health for Plymouth, you will see that bronchitis and consumption always have a great number of victims. You find the same to be the case in all large towns where the statistics are made public, and bronchitis is usually nothing more than a series of colds, whilst consumption often owes its origin to a neglected cold, as I have already mentioned. Again, you also must have noticed that there are a number of persons, some of whom may be your own acquaintances or friends, who are crippled and in extreme cases quite helpless from rheumatism, whilst others suffer from heart disease, a result of this complaint. If we enquire into the cause of the rheumatism we often find that the person has got wet through to the skin, or slept in a damp bed, or has been exposed to some draught whilst damp from perspiration, all of which are nothing more than chills or colds. There are numerous other instances which I could relate of disease resulting only from a simple cold, but I think that the few examples that I have given are quite sufficient to impress upon you the importance of trying not to catch cold ; or if, as is often the case in a temperate and humid climate such as ours, where in your occupations you are continually subject to colds, not to neglect them. It will therefore be profitable to us if we firstly inquire into the causes of cold, then some of the consequences that are likely to follow, and lastly, as to the preventative measures which we can adopt. Now before going into the causes of a cold it will be necessary for me to mention some of the chief facts in regard to the relations of our bodies to our external medium—the air. A great number of these were explained to you in the lecture I gave on Clothing, but for the benefit of those who did not attend that lecture, and in order that you may understand my subject thoroughly, I shall have to refer to some of those facts that were then explained to you. You were shown that the body remains at a constant temperature in health without any reference to the outside air, and that the normal temperature was 98·6 F., being the same in the summer and winter, in the tropics or in the Arctic regions. I also pointed out that this temperature could not vary very much in the healthy state, and should a slight rise take place the body must consequently suffer. Now this rise of temperature is one of the first symptoms noticed in what is known as a feverish cold, which causes us to feel hot, our head to ache, to feel very thirsty and unable to take much food ; it also quickens the actions of our heart and lungs. How is it then that our bodies do not follow the same physical laws as other bodies which are non-living ? You know that if a hot body is brought out into a colder atmosphere it gives up some of its heat and becomes colder, and *vice versa*, any very cold body brought into a warmer atmosphere receives heat from that surrounding medium until it comes to be of the same temperature. Now the human body is kept at an even temperature, when under varying conditions, by means of a self-regulating mechanism. The more perfect this mechanism the more readily can we adapt ourselves to changes of temperature, even sudden changes, and we are therefore less susceptible to colds, but the more imperfect this machinery the more easily are we affected by variations of temperature and therefore more liable to take cold. Let us consider what keeps up the heat in our bodies—what is our heat producer ? We may liken ourselves to a stove. A stove requires fuel to burn and the same is the case with us, for we require food to repair the waste in our tissues. In the process of digestion that food is in a sense burnt, which is changed into other substances, and I pointed out to you in a former lecture that whenever this burning—this chemical action—is going on heat is produced. In winter time we eat more food than we do in summer, and this gives rise to a greater production of heat which helps to make up for the loss due to our being in a colder atmosphere. Then there is another important point in regard to food—that certain kinds of it give rise to the greater production of heat in our bodies ; these kinds of food are the fats, fatty acids and oils, and if you consider for a moment you will see what a practical bearing this has and how natural it is for those residing in the very cold climates, or even for us in winter time, to consume a far greater proportion of these food-stuffs *per diem.* You all must be acquainted with these facts, that the Esquimau for example lives almost entirely on fats and oils. It is related of an Arctic explorer that he once endeavoured to find out the amount of fat an Esquimau boy could eat. He put before him some ten or twelve pounds of tallow candles, to his surprise the boy ate them all with evident relish. You will now also see the value of cod liver oil—a substance largely used of late years for delicate constitutions—it is very easily digested, and is usually borne by the stomach of invalids much more readily than other fats and oils, and therefore largely contributes to the maintenance of their bodily temperature. These are the dietetic properties of cod-liver oil, but it also has medicinal properties which we will not now consider. The analogy of our bodies to a stove can be carried still further. For a stove to work efficiently it must have a supply of air and a draught in order that combustion may take place and that its products may be carried off. A similar thing happens in our bodies, our apparatus is our lungs, for it brings in fresh and sends out vitiated air, or in other words, it draws in fresh air necessary for combustion and then sends out the products of combustion in the expired air. Now we learn from this, three important facts in relation to our health, and these are :—(1) the selection of foods suitable to our conditions; (2) the necessity of having fresh air to breathe; and (3) that the vitiated atmosphere should be carried away so as to prevent our breathing it again. This last point shows the necessity for a perfect system of ventilation, and stress is always laid on it in all sanitary matters.

I have briefly stated how our heat is kept up, now let us consider how it is kept at a constant pitch ; and here I shall have to refer to perspiration and the blood-vessels situated underneath the skin. I pointed out in a former lecture that the whole surface of the skin was covered by a number of holes or pores—the openings of the ducts of the sweat glands, that these glands are constantly secreting sweat which is poured on to the surface of the body; and that this sometimes takes place to a greater degree than at another and may then be seen as small beads on the surface of the skin. I also told you that sweat was to a large extent composed of water, that it was constantly evaporating and that in doing so it abstracted heat from the body, in other words it made the body cooler. Besides this I pointed out what takes place on your entering a room warmer than yourself, that you feel warmer owing to less loss of heat at first and if this were to go on without any corresponding loss, the temperature would gradually rise. I showed you how Nature endeavoured to make up for the increase by causing the sweat glands to become more active, and thus you become bathed in perspiration due to the excessive secretion of sweat which escapes through the numerous pores in your skin. I also showed what a reversal takes place on your going out into the cold air again, how all those glands are acted upon by the nervous system in order that perspiration or *visible* perspiration may cease, for I mentioned that you are constantly perspiring, but in an invisible manner when at rest, or when in a moderate temperature. Now you see what importance there is attached to the system and how necessary it is for us all to keep these pores open so that they can efficiently do their work and that they may adapt themselves to sudden changes. This shows us the use of cleanliness or the frequent washing not only of the hands and face but also of the whole body. I mentioned the dangers of sudden changes of temperature or draughts in a former lecture, how that they caused a sense of chill by suddenly stopping the perspiration and that the person ran the risk of getting inflammation of some organ of the body. You can reason for yourselves how the temperature becomes raised by the stopping of the act of perspiring or in other words how you become feverish, it is because one of the great sources of the loss of heat from the body has been cut off while the other sources cannot counterbalance the amount of heat generated in the system, the result as I have mentioned being a feverish state, and it may terminate in a feverish cold. The treatment of this complaint can in a number of cases be conducted by yourselves; you see from what I have said that the means to be adopted by you are those which will restore the sweat glands to their former activity, in other words you wish to establish a free perspiration, and it can be procured in mild cases by prolonged exercise, a sharp walk being very beneficial, and I believe this is popularly resorted to. In more severe cases we should go to bed, cover ourselves up warmly and take warm fluids such as hot tea, gruel, etc., or in cases which are not very bad the Turkish bath is very beneficial where we are exposed to a warm temperature which causes us to perspire.

The second point to which I will direct your attention to-night in reference to the regulation of the temperature is the condition of the blood-vessels situated immediately underneath the skin. You know that blood circulates all over the body, that it passes from the heart in what are called arteries and that the heart causes it to flow by means of its pumping action, every beat or pump sending fresh blood through these tubes into every part of the body. The blood passes to the lungs, there it receives oxygen and passes back to the heart to be sent through the system. It carries to the organs and muscles their nourishment, takes back their used-up material to the heart and then goes on to the lungs where the latter is excreted. The tubes carrying blood from the heart are called arteries, those returning the fluid to its veins, and between these we have what are called capillaries. The latter are the vessels which are in intimate relationship with the various muscles and organs, and they have very thin walls in order that the interchange of materials may take place. You therefore see that in every part of our bodies we have an artery conveying the blood to the part, a vein carrying blood from the part and between the two a system of fine network of vessels called capillaries. In the skin we have a number of small arteries conveying blood to it, and being very near the surface the blood in them becomes much colder by being so closely related to the much colder surrounding atmosphere. These vessels have a marvellous self-acting mechanism whereby they become at one time dilated whilst at another they contract. The effect of this is, that if they dilate more blood is contained in them and therefore the body loses heat more rapidly, while if they contract they contain less blood and therefore less heat is lost; so when this system is healthy we find them contracted when the temperature is low, and dilated when it is high. This system is intimately connected with the nervous system, the whole arrangement being a very complicated affair and it would not enhance the value of my lecture were I to describe it to you; besides it would take a very long time to explain it satisfactorily. But I will briefly demonstrate how a draught of cold air causes the vessels to contract. The stimulus of cold air on a small nervous twig situated in the skin passes up to a nervous centre situated either in the brain or spinal cord, and this sends down a message to the blood-vessels in the district causing them to contract by a separate line of communication. The stimulus of heat has the opposite effect. This is what is called a *reflex* action. You are all well acquainted with the fact, I have referred to, of our arteries becoming contracted by cold and dilated by warmth, although you have probably not been able to explain it to your own satisfaction. The effects are very manifest on the skin, for when its arteries become contracted it is pale and bloodless whilst when they dilate it is red and blushed--in reality a mild form of congestion. The relationship between the two systems that I have now drawn your attention to, viz.:—the blood-vessels and the system of the sweat glands is very intimate, the one, as a rule, acting in conjunction with the other. These body temperature-regulators play a great part in the phenomena of catching cold, and all the methods in vogue as preventatives, or rather those which help us to withstand cold, are really tonics to the skin, that is to say, they are tonics to the vessels which therefore make them act more readily. The tonic most frequently used is that of the cold bath in the morning, it not only keeps the vessels active but also the pores of the glands clean, and therefore has a double advantage. When we get into our tub in the morning we feel a sensation of chill, due to the contraction of the arteries, but this is followed (provided we have not indulged too long in our ablutions) by a sense of increased warmth, the latter owing to a dilatation of the vessels. The rule of the bath should be then not to stay too long in it, and we can determine the duration necessary each for ourselves, as it should always be followed by the warm feeling just mentioned. This brings to a conclusion what I have to say of what may be called the anatomy of my subject. I have had to go into it rather fully as without a proper understanding of it my subject would be rather incomplete. Many of the facts I have mentioned in a former lecture, but I have recapitulated them for the benefit of those who did not attend it. Let us now glance at a few of the causes of a cold. They may be divided into two sets—the predisposing and the exciting. The *predisposing* are dependent on the constitution of the individual, they are due to some peculiar condition of the system, and this is often inherited. Any person who is recovering or who has just recovered from any severe illness is more liable to be affected by sudden changes of temperature, and especially is this the case in scarlet fever. Again, the weakly are more prone to chill than those who are of a robust constitution. Those whose family history shows that their predecessors and present relatives are the subjects of such diseases as rheumatism, gout or consumption, are more likely to be affected with the disease which has so run in the family. The predisposing cause often decides what course the cold will take. For instance, a person whose family history points to rheumatism, when he takes a chill, is likely to develop rheumatic fever, and it is this predisposition that accounts for the fact, that, should a number of persons be exposed to the same atmospheric conditions the one develops one sort of complaint whilst the other develops another. In our efforts to prevent cold we should always keep the predisposing cause in view and endeavour to combat it. Therefore those who are recovering from a severe illness should especially avoid all chills, they should be liberally treated in the matter of diet, and it should be easily digested and very nutritious. Again those of a weak constitution require the same care in the matter of prevention and diet, and the latter should contain fat and oil, in fair proportion, as it is easily assimilated and very nutritious while they also have heat-producing properties. They should take plenty of mild exercise in the open air, as a large amount of it is always of great benefit to them. They will be benefited by cold baths if they are able to withstand them ; gymnastic exercise is also very valuable, especially to those who are consumptive, as it helps to increase the capacity of the chest, besides increasing the general tone of the body. Those, whose antecedents point to rheumatism as likely to develop in them, should avoid moisture of all kinds, such as wet feet or damp clothes, whether the result of rain or perspiration, while wet habitations and sleeping in damp beds are to be condemned. There are some who are constantly suffering from sore throat when exposed to cold or wet. This is in reality a sign of rheumatism in the system, and they should not wrap up around the throat too much as is so frequently done, but they should bathe the front of the throat and neck constantly with cold water. The *exciting* causes are entirely outside ourselves, and are not connected with our constitutions in the least, being usually dependent on the atmosphere. Under these causes may be mentioned sudden changes of temperature, high winds, especially when from the north or east, a very humid atmosphere, draughts, especially when striking on a warm or moist part of the body, sleeping in damp beds, remaining in damp clothes, living in damp houses, and a number of other conditions which will naturally occur to you. Some of these causes are quite unavoidable, as we must (some of us at any rate) be exposed to some of them in our endeavour to get our livelihood, but we can all do our best to minimise the risk by wearing clothing suitable to our occupations and whenever we get damp or wet we must be sure and avoid all causes likely to chill us. The exciting causes may also be materially diminished by keeping our temperature-regulating mechanism in as healthy a condition as possible, for the more readily it responds to the duties it is called upon to perform the less likelihood there is of sudden changes affecting us. Now I will review some of the most familiar forms of the disease known as a Cold. In the first place I will draw your attention to the affections of the respiratory tract, as this is most frequently attacked. The apparatus necessary for breathing may be divided into two parts for practical purposes. The first, the upper, which conists of the nasal passages, back of the mouth and throat, and the *trachea* or windpipe, serves for the purpose of warming and filtering the inspired air. The other, consisting of the lungs proper, doing the duty of aerating the blood. It is necessary that the air we breathe should be warmed before it reaches the lungs in order that they shall not be chilled, but under certain circumstances, such as a sudden fall of temperature or even a very cold and dry atmosphere, the air does not become sufficiently heated, with the result that we get a chill, and naturally those parts of the heating apparatus nearer the air sooner and more often become affected. In an ordinary cold, or what is often named *Influenza*, these parts are involved, and besides the general malaise and feeling of chill which accompanies it we get symptoms of irritation or congestion of the mucous membrane of the nose, shown by sneezing and a running at the nose following a dryness of the organ. These are the chief symptoms. In severer cases a greater length of the respiratory tract becomes involved, namely, the back of the throat and the top of the windpipe, and we get as symptoms dryness in the throat with irritation of the *larynx*, which causes us to have a dry spasmodic sort of cough. If it implicates the vocal cords our voice becomes lower in pitch, while talking causes us pain, and this often passes on to *aphonia* or loss of voice. Should the attack be more severe the *trachea* or windpipe and bronchi become affected ; then fever presents itself ; we feel hot and thirsty, the skin becomes dry, we complain of nausea, the appetite is lost, and there is that peculiar uncomfortable feeling of sense of fatigue, cough is also present, being at first hard and dry, but later it becomes moist. Expectoration of mucus also occurs, this gradually subsiding as the attack passes off. These symptoms are those of acute bronchitis, or acute bronchial catarrh, which if not attended to is likely to cause serious mischief, ending in some of those chronic lung complaints. This often happens after repeated attacks. Pneumonia, or inflammation of the lungs proper, may be the result of a cold, and it is a very dangerous complaint, often leading to consumption. I have mentioned that very cold air sometimes causes a cold, but this does not happen as a rule unless there is that predisposing tendency that I spoke of, in fact, we often recommend those suffering from pulmonary weakness to go to some bracing climate where there is not much wind prevalent. Davos Platz, in Switzerland, is strongly recommended on this account by physicians, as the air there is very still.

The next form of Cold to which I should like to draw your attention is Sore Throat. It is a complaint of very common occurrence but not of a serious nature. The back of the throat and mouth, in the first place, feels dry, there is a certain amount of fever, varying in different cases, with pain in that region, and later a difficulty in swallowing, due to the swelling of the tonsils, while sometimes you have abscesses formed in them. These cases are often peculiarly intractable and are very liable to recur. They should be guarded against as they often pass into a chronic state, the tonsils being more or less permanently enlarged. Some people never have a cold unless their throat becomes affected, and this is to a great extent of their own causation, for when they have suffered once from the complaint they invariably cover up their necks with all manner of wraps to protect themselves from taking cold again, instead of not wearing their throats so unexposed. It is also of great benefit to them if they apply douches of cold water to the front of the neck and chest every morning. Of course these remedies must be used after the early attacks, as they are of no service when the disease has passed into a chronic stage, in fact, they probably would be hurtful.

The next form of Cold that is of frequent occurrence, especially in a climate so damp as this, is Rheumatism and its first cousin, Neuralgia, as they are more or less associated together. There are various forms of rheumatism. There is Myalgia, or muscular rheumatism, which affects the muscles principally, but the most common form is Lumbago, affecting the muscles of the back. There is also stiff-neck. Neuralgia is an affection of the nerves generally attacking those of the face, popularly known as Tic-douloureux. When it affects the joints it is much more serious and is known under the name of acute rheumatism or rheumatic fever. It generally gives rise to pain in the smaller joints, but is of a fleeting nature hopping from one place to another ; the joint often swells and is extremely painful on movement. The cause of rheumatism is often a cold current of air blowing on some heated or perspiring part of the body. This is often the case when the draught is not felt, when the air is not travelling fast, and so is often unavoidable as one does not perceive the risk he is running at the time. But there are other causes which one can avoid and which frequently are not looked after. The chief of these are getting wet feet and not changing the stockings, sleeping in damp beds, living in damp houses, getting wet and allowing your clothes to dry on you, and a number of other similar circumstances. Rheumatism can often be warded off by wearing woollen underclothing, and I showed you in my lecture on Clothing how this acts by its being a bad conductor of heat, thus not allowing changes of temperature to affect you so easily, and by its being a good absorber of moisture, when you get damp from perspiring, it is absorbed, and heat is not therefore so quickly lost. Those who wear flannel should always remember to take it off at night in order that the moisture absorbed shall evaporate, otherwise your flannels may be damp all the time you are asleep. This brings to a conclusion the forms of cold to which I wish to draw your attention, although there are many other varieties of disease induced by a chill, but I have mentioned those which are of primary importance and such as you can in a great many instances keep yourselves clear of, by paying attention to the precautions that I have laid before you and I wish to impress this upon you—for " Prevention is better than cure"—and many a ruined health would have been saved, aye, many a death would have been averted if only care had been taken to prevent catching cold, and I would earnestly entreat that the matters of detail to which I have referred (many of them no doubt being nothing but common sense and such as you are well acquainted with) would be taken to heart, for then you would save yourselves and your children a deal of unhappiness and misery. But with all your precautions and with all your care you sometimes are unable to avoid catching a cold, and so I think in conclusion I cannot do better than rather briefly state some of the measures you can adopt to get rid of the enemy. Many of them have been brought before you in a former lecture, viz.: Clothing. I then showed you that in all cases the establishment of a free perspiration is the main point. In cases where the cold is not severe this may be arrived at by a sharp walk or some equally powerful sudorific in the shape of muscular exercise. When this is sufficient to produce perspiration we should be very careful that we do not aggravate our malady by adding another chill, as one is very apt to take cold under the circumstances. So the best thing to do is to go home as soon as the sweat glands begin to be active and take off our woollen underclothing and rub ourselves well, but if the cold is at all severe it is better to go to bed for some hours. In some cases the cold is so severe that we are unfit for muscular exercise, we feel hot, feverish and thirsty and so on, the result of a rise of our temperature, and in these cases it is better to go to bed at once and cover ourselves with plenty of blankets and make use of some hot fluid, such as tea or gruel, in order to try and induce perspiration. As regards the taking of alcohol when we feel feverish, etc., I think that its use is contra-indicated but when perspiration has been fairly established then a drop of warm grog may be beneficial in order to keep it up. When we have produced a free perspiration it had better be kept up for some hours as it helps to carry off the poisons in our blood. After a time we begin to feel cooler and more comfortable, and may perchance fall asleep. The clothes which have been used in the bed should be changed and well aired and dry ones substituted for them in order that we may not lie long in damp clothing. The establishment of a free sweat is always aimed at by a medical man when he prescribes in cases of cold, and one of his ingredients in his mixture is, or should be, for that purpose. So you see you are only forestalling his treatment by endeavouring to do the same. When the case is more severe than the one just described ; when there is a long period of shivering or feeling cold followed by any degree of fever, and especially if there be any pain in the chest (as this suggests inflammation there—pleurisy or inflammation of the lungs) or the several joints of the body (showing that rheumatic fever is probably approaching if not established), you should immediately seek the advice of a medical man, for by so doing you avert considerable danger, as what you think is only a cold may be some grave malady, and this may be cut short by the early assistance of a physician. Any symptoms of disease in children, when accompanied by fever, should always be attended to, as many of the complaints peculiar to this stage of life begin in a mild form not unlike a cold. I think I must have exhausted all your patience by relating such simple facts as I have to-night, most of them being well known to you all, but I was of opinion that by mentioning them you would comprehend the great amount of mischief caused by such a simple thing as a cold and endeavour to minimise it.

HEALTH & RECREATION IN CHILDHOOD.

" *Thy glass will shew thee how thy beauties wear.*"

SHAKESPEARE, Sonn. 77.

" *Were you well served, you would be taught your duty.*"

RICHARD III, I, 3.

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> RICH. III., 1, 3.

HEALTH AND RECREATION IN CHILDHOOD.

I HAVE included the subject of "How are we to take care of our little ones" in these lectures, as I considered that if these addresses are to be practical they must not only aim at improving the health of those of the present generation but also of those who are to take our places when we are no more. Any one who has studied the returns of the death-rate in any large town must realize what a great sacrifice of infant life there is annually, and what a high death-rate there is among children. Those who have not even looked at returns such as these only know too well that the number of children who never reach the age of five years is very large. No doubt some of these deaths are attributable to causes which cannot be prevented, but I am sure there cannot be a doubt in the mind of any one present here to-night, that a number—a great number—of children die from causes that are preventable and which ought not to exist. Let me impress on your minds, that although death is the lot of all mortals yet it is unnatural in a child. Of course we all know that it is impossible for all the children that are born to be reared up to manhood or womanhood (as the case may be), yet, nevertheless, I feel certain you must all be aware of the fact that numbers of infants die from neglect. Now let me give you a few statistics. Dr. Vernon when lecturing for the Manchester Health Association, some years ago, on the subject "Why little children die," said, that in a small parish in Northumberland, which contained 200 people in 1874, not a single child had died there for 20 years; and yet considerably over 100 children must have been born in that period. Dr. Ashby, when lecturing for the same Association in 1882 tells us that in Manchester for every 100 children born, about 21 die before they reach one year old, and that about 30 children die out of every 140 born. Now let me illustrate this still further. Dr. Maccall tells us that in the Census of 1871, in the whole of England, 158 children out of every 1,000 born died before they reached the age of one year—a much higher rate than it should be, that in certain districts this is much lower, and that among the upper and professional classes only about 80 per thousand died in the same period. In Manchester he stated that 213 out of 1,000, or more than one in every five, died under 12 months old, and the loss of life fell still more heavily on the working classes. Now let us come nearer home, without going into statistics, we have only to look at the number of hearses carrying their grim and youthful burdens to convince ourselves of the amount of infant mortality existing in our midst. What does this teach us? That the lives of numbers of little ones are perishing on the eves of their careers, before they have enjoyed the pleasures or the responsibilities of life, from causes that are in existence here, but not in the little village in Northumberland just mentioned. We do not want statistics to show us this, for every medical man who has been connected with the work of a dispensary, or the out-patient department of a hospital, knows only too well that there are numbers of children brought there with death only too plainly written on their faces, and others whose history shows that if they do survive they will probably only drag out an existence, being sickly all their days. This is a very sad picture to gaze upon, but I have in no way coloured it. I have not in the least over-drawn it, it forces itself upon us in the alleys of our great cities. I have stated nothing but facts. Now, is all this loss of life absolutely necessary under the present state of affairs, when competition is so rife, when the struggle for existence is becoming harder every day; is it unavoidable? There can be no doubt that it has had its origin in the congregating of masses of people together, and the mode of life connected with their several occupations. But cannot it be minimised? Is there nothing that we can do to help them against this loss of health and happiness; against the misery that is likely to befall them in the future, should they be fortunate enough to live as long. Should not we all do our best to help the helpless, to strengthen the weak? If we hear of any great accident, any large fire, or anything that causes great sacrifice of precious lives, our heart strings are then set in vibration, do we not then feel that we would do anything that lay in our power to avert a similar catastrophe in the future ; why should not then an effort be made to rescue the various precious lives that are daily being sacrificed in our midst, when some of its causes are able to be removed. It is with the object that some of you present may exert your power to benefit these little ones that I am addressing you to-night. In the health of the people lies the greatness of a nation, and many a country can trace its destruction to the decay of its youth, for as we cannot build a house of materials that are devoid of strength, we cannot expect to make a great nation out of weak and sickly children. "Childhood is the seed-time of life," and never was a truer word spoken ; if we sow a childhood with unsuitable food, with bad clothing, with little or no recreation, we shall surely reap a harvest of sickly man or woman-hood, provided that harvest ever be reached. A great deal of good has been done by our sanitary authorities in the matter of reducing disease and death, by the various methods adopted by them to secure healthy homes : by having houses well built, the water supply good, and drainage of an efficient if not of a perfect kind. These are all very good in their way, but unless supplemented by lectures now and again which will direct and guide individuals themselves, their benefit must be to a great extent marred. The amount of ignorance that exists among some classes, relating to the primary laws of health, is very great, and medical men are constantly having the fact brought under their notice when visiting their patients, and anything that can enlighten them on some of these laws, I am sure will receive their grateful thanks. I trust that before long some of these elementary rules will be taught in our schools, for I am sure it would confer an inestimable boon on the community, and I am of opinion that as much if not more good would result if some of the time devoted to the intellectual education of a child was spent on its gaining a knowledge of those primary principles of laws relating to health. Now supposing we have a child born perfectly healthy, let us consider some of the conditions that will give it the very best chance of becoming a healthy man (or woman). The first subject to which I will direct your attention, is that all important one, "food," and the first question that naturally arises in the mind is, should the mother suckle her child? And the answer to it is emphatically yes, except in those cases where the medical attendant from some special reasons prohibits it. Milk is the most perfect food of all, containing every constituent necessary for the support of life. How wisely does Nature direct us in all our actions ! It is the food provided by her, and cannot be supplanted by any combination of man's ingenuity. How often do we find that milk is not looked upon as a food ; we are constantly told by mothers that milk is a drink, they say they give the child biscuit or some such food when it is hungry, and when it is restless and wants a drink, they give it the breast. No other form of food has or can be devised on which to feed infants for the first few months. The amount of mortality amongst those who are brought up by hand, is far above that of sucklings; for in France there are what are known as Foundling Hospitals, where children are sent to be reared, and here the mortality varies from 30 to 50 per cent, in some cases even being as high as 80 per cent. The curd (casein) and albumen (serum-albumen) contained in milk supplies the necessary materials for building up the muscles, brain, etc.; the fats or butter, (glycerine, margarine, palmitine, and oleine) supply the fat to the body; the sugar, called lactose, ($C_{12}H_{22}O_{11}$) by its oxidation, gives rise to heat in the body; and the salts (calcium phosphate and phosphate of iron) give the necessary substances for building up the bones, teeth, etc., they give to them their hard character. So you see every constituent is there necessary for the maintenance and growth of the child. If possible, therefore, the sole food of a child for the first six months, should be the milk from the breast; after this period, it is better supplemented with some other food, such as cow's milk, as the prime source of its food is then becoming thin and weak, and therefore it cannot supply all the wants by itself, and the digestive powers of a child by this time are greatly improved, so that they can make use of different kinds of food. When the child has arrived at the age of nine or ten months, it should be weaned, for when fed too long on human milk, children do not thrive, and besides, such diseases as rickets, etc., are likely to develop if they are kept too long on it. Now, supposing from any cause the child has to be reared without the aid of its mother, then what food should we use? We cannot do better then follow Nature's example, and give milk of some sort or another. Milk from its various sources has been analyzed, which analysis I give you in the following table:—

ANALYSIS OF MILK. (BLOXAM).

	COW.	ASS.	GOAT.	HUMAN.
Water	87·4	90.5	82·0	88·4
Butter	4·0	1·4	4·5	2·5
Sugar and Soluble Salts	5·0	6·4	4·5	4·8
Casein and Insoluble Salts ...	3·6	1·7	9·0	3·8

COMPARISON OF HUMAN MILK AND COWS'. (KIRKE.)

	HUMAN.	COWS'.
Water	890	858
Solids	110	142
	1,000	1,000

SOLIDS.	HUMAN.	COWS'.
Proteids	35	68
Fats or Butter	25	38
Sugar (with extractives)	48	30
Salts	2	6
	110	142

It will be seen that the one corresponding most to human is that obtained from the goat, and is therefore the best to use, but it is so very difficult to obtain in this country, that it is seldom ever resorted to. It also has the disadvantage of its curd being very dense, and is likely therefore to excite vomiting. The next best and most generally used source is from the cow, and it forms a most excellent substitute for human milk, but contains a far larger proportion of curd and albumen. It is therefore better diluted with water for the first few months, as the infant's digestion is not powerful enough to use it pure in a number of cases, which gives rise to uneasiness and vomiting, if undiluted. The amount of sugar contained in it is less than that obtained from the human source, and a little sugar should therefore be added; it is very useful also to add a little lime water to it. To sum up then, the milk should be diluted with about an equal quantity of water, a little sugar added, also a teaspoonful or two of lime water, and lastly it should be heated to the temperature of the body, say 100° F. You should also scrupulously avoid using anything but fresh milk, and all vessels in which it is kept should always be very clean, for otherwise fermentation takes place, which gives rise to various acids, the chief of which are lactic and butyric, and these cause irritation of the stomach ; this is the cause frequently of so much stomach and intestinal mischief so prevalent in infants. In some cases cow's milk is found not to agree with a child, and then it is best changed, and something else substituted for it. Condensed milk then may be used for a time, or some such food as Nestle's or Oettli's milk-food, or better still that excellent preparation known as Benger's Food. Should none of these be found to agree, the advice of a doctor had better be sought. In children brought up artificially, the greatest care should be exercised at first, for the chances of death diminish weekly, the greatest mortality occurring from affections of the digestive organs during the first two or three months. Children should be fed entirely on milk for the first few months, and then a little farinaceous food should be alternated with its milk, and I wish particularly to draw your attention to this, for the cause of a great many deaths is due either to the practice of giving such foods too early, or keeping the child too long on milk alone. I will now quote the dietary given by Dr. Ashby for a child from six months to twelve months old, and it seems to be very efficacious :—

DIET FROM SIX MONTHS TO TWELVE MONTHS OLD.

(Five meals a day.)

First Meal, 7 a.m.—One teaspoonful of some farinaceous food to about twelve tablespoonsful of sweetened milk, well boiled.
Second Meal, 11 a.m.—The same quantity of pure milk.
Third Meal, 1-30 p.m.—Same as first.
Fourth Meal, 5-30 p.m.—Same as second.
Fifth Meal, 10 p.m.—Same as first.

You will see from this that the quantity of farinaceous food is small in amount, but as the child gets older it may be increased ; until the child has reached six months of age it should not be given such foods as bread, corn-flour, etc. The farinaceous food may be varied ; meal made into gruel, bread, rusks and dry biscuits crushed, or any of the many patent foods, all of which are very serviceable. Robb's biscuits, Dr. Ridge's, Neave's, Mellin's, and Liebig's Food being among the best, but you must always take care that they are well cooked. Let all these foods be made with cow's milk, when this does not agree, change it with the condensed milk, but mind that you do not keep the child too long on the latter, as it is very sweet—containing a large percentage of sugar—and the casein and albumen is rather small in proportion ; and so the child if kept exclusively on it, together with a little farinaceous food, is likely to fatten rather than develop and get strong, as the casein, etc. are the muscle-forming elements, but sugar gives rise to fat ; so the children get plump by using it, but the muscular elements are not properly formed and these children although they look so fat and healthy are unable to stand illness of any degree. At the end of the sixth month the front teeth often begin to make their appearance, and by the end of the first year the child generally has the four upper and two lower ones. When the front teeth are through, biscuit or crust of bread may be given to it to nibble. From the age of twelve months to eighteen months the food is much the same. I will again quote from Dr. Ashby the diet he thinks suitable.

DIET FOR A CHILD FROM TWELVE MONTHS TO EIGHTEEN MONTHS OLD.

(Five meals a day.)

First Meal, 7 a.m.—Bread and milk, or oatmeal or hominy porridge, with plenty of milk.
Second Meal, 11 a.m.—Twelve tablespoonsful of milk.
Third Meal, 1-30 p.m.—Bread crumbs and gravy, or an under boiled egg and bread and butter.
Fourth Meal, 5-30 p.m.—Bread and milk.
Fifth Meal—Milk to drink.

You will see that here a little more substantial food is given, and for the gravy, plain soup may be substituted. You will also notice that although such be the case milk still enters largely into the diet, and I must warn you about giving too much of the more solid foods at this period to the expense of milk, for at least one to two pints of the latter should be given daily. From the age of 18 months upwards the food should be light and wholesome for some time, milk entering largely into the dietary. When the double teeth are cut, small allowances of fish or meat may be given once or twice a week. If either of them are made use of they should be well minced, and meat is very nice mixed with bread crumbs. Oatmeal or whole meal is an excellent article of diet, and I would strongly recommend its use. Rice, stewed fruits, bread-puddings (that are light and not rich) are all very useful. But all the heavier kinds of food, such as pastry and highly spiced articles, should be avoided, and the practice of giving pieces of indigestible, although tasty, food from your plate is to be condemned. It may seem rational and natural to some to give their children some of the little dainties they are themselves enjoying, and which the children seem to like, but many errors of health, due to indigestion, might be avoided if they were not given. Some children are naturally of a very delicate constitution and are like hot-house plants, requiring much care and attention, and especially is this the case in their dietary, as you want to build up their constitutions with the smallest waste of energy in their digestive apparatus. So in these cases, especially should there be a consumptive tendency, you will find the use of the Extract of Malt very beneficial, as it is a highly concentrated and nutritious digestive food, as a rule fairly easily borne by the stomach, and therefore much to be commended. You will find the Kepler Extract one of the best, as is proved by the fact of its extensive use.

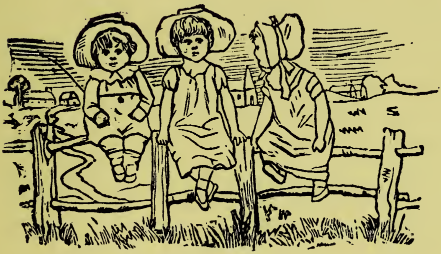
I should also like to emphasize what I have already mentioned in my previous lectures, and that is, do not (if your child be healthy) on any account, give them alcohol in any form, they are far better without it. Until the child be well grown up, and even then let all farinaceous foods enter largely into the diet, for then, fewer diseases of bones will be the result. I have gone rather minutely into this part of my subject, because a great number of the diseases of infancy are caused by errors of diet, and they are often, I am sorry to say, put down to teething. You would be surprised at the number of cases that are brought to us which we find on a close examination are due to a bad dietary, and when corrected, health is again restored. Before closing this part of my subject, I would like to make a few remarks on the very objectionable practice of giving various drugs to infants under the idea that they are teething, and that they will confer benefit on them. Let me tell you that this is entirely erroneous. A child, if healthy and properly looked after, does not get ill from cutting its teeth, and even supposing it did, then the opiate administered under the name of teething-powders, etc. would do it far more harm than good. Pray let me warn you not to give your children any soothing syrup, cordials, teething-powders, etc., for then an untold amount of misery will be avoided. If a child cannot sleep or rest it must be in pain (perhaps due to its diet) or ill, and then if you cannot assign a cause, seek the advice of those who can and will, but do not give your child opiates, for, as I pointed out in a former lecture, you little think that you are playing with a double-edged tool, and that the amount of injury you are thereby risking is more than you bargain for.

The next part of the subject which will engage our attention is the matter of Cleanliness, Clothing, etc., and here I shall have to go over some of the ground already travelled in my former lectures. In order that a child may enjoy health to its fullest extent, it is absolutely necessary that it should be properly clad. The muscles of a child are in a state of more or less constant activity, and as a result of that exercise there is waste and therefore necessity for repair. This repair takes place during sleep and rest, the materials to supply the want being those of food and air. The various waste products are removed from the body by the several excretory organs, one of the chief of these being the skin. It is studded with an immense number of small pores, the openings of the sweat glands, something like two millions being present, and from them the perspiration is constantly evaporating, being invisible except when we are undergoing severe exercise. You see how important it is that nothing should occur which should block the entrances to those glands, and hence the necessity for great cleanliness. Should the pores become occluded from any cause, we get various disorders of the skin, which give rise to eruptions, and not only this, but other of the excretory organs are likely to suffer as extra work is thrown upon them, for as I pointed out in my lecture on Clothing they act reciprocally. The importance of cleanliness is therefore apparent. The child should always have one, if not two (one morning and evening), baths. At first this should be slightly above blood-heat, but as the child gets older it may gradually be made colder. The morning tub should be continued throughout life provided the person is healthy and able to withstand it. Some are unable to indulge in the luxury, during some parts of the winter, as they cannot stand the cold, but if they add a little hot water so as to raise its temperature, they will find benefit arises by continuing the bath all the year round. Let me remind you that the use of the bath is two-fold in its effects, for not only is cleanliness ensured but also the skin and the underlying blood-vessels receive a first rate tonic, and by it we are able to withstand great variations of temperature without catching cold, and thus keep clear of a vast amount of disease. Now let me draw your attention to the matter of Ventilation, a very important item if we wish to maintain a healthy standard. During breathing, we inspire *fresh* air, and expire air containing some of the waste products of our body, this is thus one of our excretory channels. The air that has been breathed contains little or no oxygen, its place being taken by effete matters, which are animal matter, carbonic acid gas and water in a state of vapour. We, as it were, burn the oxygen of the air. The products of the combustion contaminate it, and one of them (carbonic acid gas) is a poison, and therefore we cannot breathe the same air over and over again with impunity. If we were put in a case and it were hermetically sealed, thus preventing the ingress of any fresh air, we should find that we should die of carbonic acid poisoning after a time, by the accumulation of this exhaled gas. There is always present in the air about ·04% of carbonic acid, but when this rises to ·1% the air is unfit to be breathed, and if it reaches as high as ·7% it possesses a very unpleasant odour. Air, containing 1-10th% of carbonic acid gas, often gives rise to headache, but this is not due to the gas present, but to that organic matter which I mentioned as being one of the products of expired air. The amount of the gas though is a good index of this putrescible organic matter, for they are always proportionate. Now what breathing space should be allowed to each individual? The amount of air must be enough that it will not have to be changed too fast, as otherwise a draught would have to be caused in order that this might take place. The carbonic acid should be kept as near to ·04% as possible. If an individual be placed in a chamber containing 1,000 cubic feet, it is found that in order to keep the carbonic acid as low as ·06 per cent, it has to be changed three times in an hour, and so this ought to be the amount allowed to each individual, as we cannot easily change the whole of the atmosphere in a room more than three times in an hour without causing a draught. If the air be at 60° F. and travelling at the rate of from one to two feet per second, it will not cause a draught, but will answer the purposes of ventilation. The velocity should never exceed nine feet per second, it is better to enlarge the channels of ingress. The matter of keeping the air good is of great importance to children, as they are affected by a vitiated atmosphere more than adults; many cases of consumption are traceable to bad ventilation, for the children are brought into a low state of health, and should they be predisposed to that dire complaint it may start, as they are more susceptible to any ailment, not being strong enough to ward it off. When visiting patients the fact that ventilation of the sick room is not atttended to is forcibly presented to us, for on entering we find the atmosphere is very foul. The people seem to be so afraid of opening a window for fear the patient, may catch cold, but with a little foresight and care all draught may be avoided. Now what are the channels of ventilation in a room? They are the windows, doors, fireplaces, and in some instances ventilators. The latter are of great use when present but I have not time to discuss the varieties and the several claims of each to-night. Fireplaces are very valuable, their value being increased when there is a fire in the grate, as then a larger draught is caused, but at the same time of course more oxygen is being used for its combustion. Doors are poor means of ventilation, for at the best they admit air that is in the house, and therefore probably not very pure, and so they should not be relied upon to change the atmosphere in a room. These remarks of course refer to the doors of rooms, and not to the front door or to those that communicate with the outside air, for these latter are valuable aids, but practically unsuitable. So you see we have to depend mainly on our windows to supply our rooms with fresh air and they should therefore always be opened once daily for a little time, preferably in the morning. This is especially desirable in the sleeping rooms, as the breathing space there allotted to each individual is comparatively small. Our great object then should be to keep the air of our apartments as pure and fresh as possible, but to avoid all causes of draught. The next thing concerning the health of childhood to which I will refer is Clothing. I will be very brief as I have already drawn your attention to this subject in a former lecture. Let me remind you that the essentials of clothing are a bad conductor, in order to prevent loss of heat from the body, a good absorber in order that perspiration may be removed as soon as it appears on the surface of the skin, and lastly it should be porous so as to allow the exhalations from the skin to pass away quickly. All these essentials are present in flannel and it is therefore the best material wherewith to clothe our children. Children are far more sensible to variations of temperature than adults and therefore more susceptible of taking cold; they should therefore be warmly clad. In the second place the clothes should never be tight, otherwise the movements of the muscles are hampered and respiration impeded. When muscular movements cannot freely take place development is retarded, and we therefore should guard against the use of any clothing which does not give free play to the muscles. As far as babies are concerned there is not much to complain of, the only fault that can be found is the inordinate length of their garments, but I am afraid no words will be able to alter that state of affairs as long as mothers and nurses think it pretty, for then it also is fashionable, alas! But when we look at the clothes of the shortened child, from a scientific view, it is anything but desirable. I refer to that objectionable manner of leaving the chest, arms, and legs uncovered. We have continually to remind you of this, for although we are always waging wars against it we do not find much improvement taking place. The amount of mortality that arises from this cause I cannot estimate but I am sure it is large, as the great prevalency of chest complaints in children tells us so and they are undoubtably traceable to this cause. One of the most sensitive and vital parts of the body is exposed—the chest. The reason why low dresses are so commonly worn is because mothers consider it pretty and the fashion. Pretty, undoubtedly it is, for no clothing can ever be so artistic and fine as Nature herself, but reason should have a place. Would a mother leave a child nearly naked because it was pretty? Certainly not! But then they also have that absurd idea about hardening which I mentioned in a former lecture; they proudly point, if remonstrated with, at the little ones rolling about in the streets half naked and say to you "Look how well that one looks, and he is not clad as you say," but they forget that they are pointing at those who, because of their strength, have been able to survive the cold and exposure. They do not reckon that all the weak under these conditions are each lying within their narrow beds, having died in their battle with this enemy. They forget that they are pointing at the survivors, who of necessity must be strong. I have emphasized this, because I know to what extent this cause of ill-health in childhood is prevalent. I know how feeble any attempt of mine is in endeavouring to minimise this evil, but I cannot let the subject pass without putting forth a *feeble* effort to try and prevent the practice of exposing the chests of children from becoming greater in extent. You should most certainly try and make your children hardy, but not by these means. Let them have as much fresh air as possible, but let them be well clad, in order that they may be kept warm.

The last thing to which I will refer to-night is the subject of Recreation and Exercise. In the first place there is a great difference as to the quantity necessary for the child, as compared with the adult. In the latter there requires to be a certain amount taken for the health's sake, and this will depend on the nature of the individual's employment. If it be active, his recreation only need be of a mental nature; but if he be working at the desk all day, it will necessarily partake of a more active sort. In the case of the child it is different, for not only has sufficient exercise to be taken to maintain a healthy standard, but also more is required in order that development shall proceed, and if we wish this to take place to the fullest extent, that is if we wish the body to grow well proportioned, it should be large in amount. You are all familiar with the fact that exercise increases the size of muscles. Nature has wisely arranged that where there is use, where there is power wanted, there shall muscular development proceed faster. Many familiar examples will arise in your minds—the brawny arm of the blacksmith, the size of the biceps of the right arm as compared with that of the left (that is in right-handed persons), the size of the muscles of the calf in a heavy man as compared with those of one who is light. You all know how gymnastics increase the size and power of the various muscles, so you can easily understand the power for good that exists in proper recreation and exercise during childhood. The child has all the various muscles but only in a state of parvity, the whole man is there, and it should be our aim to evenly develop every part to its greatest extent, and if any seems to be puny that should receive special attention in order that it may become proportionately large. Exercise should not be carried too far, otherwise over-fatigue will be the result, and this is the reverse of what is wanted. For when it occurs the muscles and organs become wasted, and far more rest is then necessary in order that the wasted parts may become recuperated. There is another essential point if exercise is to be of any value, viz., that it must be taken regularly, and different kinds should be indulged in, so that all the several sets of muscles are called into action in order that development may proceed equally. We see from its earliest days the child delights in exercise. Nature instils into them a desire for movement. Just watch a child commencing to expand its faculties—its greatest delight is to be freed of all its clothing in order that it may kick and move its arms and legs. In infancy, a child is sure to take sufficient exercise, for in it the strong innate imitative faculty leads it to attempt the movements of its elders, and in doing so calls its muscles into play often enough for all its requirements. As it gets older it should be laid down unfettered by those lengthy inventions of man, or rather woman I should say, and be allowed the free use of its limbs. Let it kick and roll about as much as it likes, and bye and bye it will begin to crawl, and at last walk, that stage anxiously looked forward to by mothers. Although there is this desire amongst parents to see their children go alone early there is a danger attached to it, for in a number of cases the anxious mother puts the child on its feet too soon, Nature often advising strongly against it, by the child being undesirious of attempting to stand, and the result is crooked legs, the bones being not sufficiently firm to support the whole weight of the child's body ; the lime-salts not being present in sufficient quantities, as they are the agents which render the bones firm and rigid. What lesson do we learn from this? That we should not be in too great a hurry to get a child to walk. If the infant has not the inclination we are very unwise to go contrary to it. As a rule children take to their feet quite early enough, the difficulty often is to prevent them from walking before their legs are strong enough to bear them. If the matter of milk in the diet be attended to in the manner I have laid down, you will find that the bones will harden quite soon enough, and the ricketty condition so common now a day in all our large towns will not so often be seen. As the child grows older it will take exercise on its own account, and it should be allowed to engage in all the various games, as by these means all varieties of combinations of the muscles are brought into use. They should be sent out in the open air as frequently as possible, but this is difficult and dangerous I know in our towns as there is always a risk of their being hurt by passing vehicles. The air in towns, too, is generally anything but pure, and so it is doubtful whether much benefit can be derived from allowing them to amuse themselves in them. This has of late years received more attention, and now there is a decided movement in favour of large open spaces, in the shape of parks being made in them, and I only hope that it will continue, for we can well afford to accommodate a few more of them in our great cities. At present there are far too few of them, and they are at too great a distance in many instances to be of any real value to the city. There cannot be any two ideas as to their great efficacy in reducing mortality, and at last the nation seems to realize the fact and is awakening to its sense of duty. The early life of a child should be free from any worry or trouble, although these do not often have much attention paid heed to by children. We should try and do all that lies in our power to make early life happy, for we cannot expect our little ones to thrive if they have anything troubling their minds. And here let me remind you of the pernicious course resorted to by some of frightening children in order to get them to do something. It is a practice most objectionable and to be condemned in the most vigorous manner. It is sometimes resorted to in order to try and get a child to sleep, but common sense teaches us how futile is the attempt likely to be, for how can we expect the brain to be composed when we are stimulating it by such distasteful practices. I am sure if only a a moment's thought were given at the time this would never be resorted to. If we would only consider for a moment what amount of injury is likely to be done to the child, how its future health and happiness is likely to be affected, we would be the last to use such an instrument I am sure, for many a case of nervous disease can be traced to the effect of fright during childhood. Now at what age should a child be sent to school? The older idea was that work should not be commenced until the child was six or seven years old, but since the laudable Kindergarten system has been introduced this might be certainly much earlier. I think that a child might be sent to the Kindergarten as early as the age of four, for their work, if it may be so called, is very light, partaking more of the style of amusement. In fact, this system is only play in which children are taught some useful lessons. Up to this time boys and girls are equally placed as regards exercise, but gradually the boys gain a distinct advantage, the amount of difference getting larger as they grow older. As far as boys are concerned little fault can be found, for their games give them all manner and variety of exercise. Those who are inclined to be narrow chested and consumptive cannot do better than amuse themselves in the gymnasium, only they must be careful not to exercise themselves too violently. Girls unfortunately are placed at a disadvantage as they grow older for they cannot indulge so freely in exercise on account of their dresses, as they hamper their movements. I think it a pity that they do not take more violent exercise, they might easily do so without becoming rough and their health would be much the better for it. It would be very good if gymnasiums were erected in connection with all girls schools, as this sort of exercise would help to supply the deficiency, although it never could be equal to the more active exertion out of doors. There is a very difficult question to answer as to how much time should be devoted to work and how much to recreation. You know that

> "All work and no play
> Makes Jack a dull boy,"

and I am afraid that in the present day when competition is so rife, when necessarily education must take a prominent part, that we err on the side of giving too much time for work, and thus run the risk of imperiling the health of the child. I think we often expect too much from the boy or girl, especially if not quick at learning, and the latter often have to sacrifice the time that should be spent in recreation in order that they may be able to keep pace with the brighter ones. You must have, if possible, "A sound mind in a sound body." You cannot expect to have a high standard of education if you do not have a high standard of health. Health must be considered first and education next, a teacher cannot do his or her duty effectually when the health is below *par*, for the brain partakes of the general condition. I have endeavoured to-night to show you the importance and advisability of maintaining perfect health, or as near that standard as possible, during childhood, and the various means you can adopt to bring about that condition. You know that "Health is better than riches" as those who have suffered much and long can testify, and if you can in any way be the instruments whereby the former may be obtained, those for whose benefit you have laboured will look upon you with pride, and bless you far more than if you bequeathed to them all the money in the land.



EATING AND DIGESTION.

"*Enough is as good as a feast.*"
PROVERBS.

"*What is one man's meat is another man's poison.*"
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EATING AND DIGESTION

I HAVE chosen as the subject of my last Health Lecture "Eating and Digestion," for I was of opinion that if you had the whole physiological process, known as digestion, explained to you you would be able to understand the several values and uses of our varied articles of diet, and as fault in the dietary is very frequently the cause of aberration from the healthy standard, you can with a knowledge of this process understand how this departure from health is brought about. Now, what do we mean by eating? It is the mastication of the food, whereby it is brought into a state that it may be acted upon by the various secretions of the alimentary tract. The general use of the word conveys that it is the mastication and deglutition of *solid* food, we speak of eating meat, bread, etc., but drinking water or ale. This interpretation of the word is not what I wish you to understand by it to-night. We must use it in a wider sense. Eating then will mean the introduction of food, whether it be *solid* or *liquid*, into the alimentary apparatus, in order that it may become digested. What is digestion? It is the process by which food is rendered capable of passing through the walls of the alimentary apparatus into the blood-vessels and in such a state that it shall be of service to the body. Foods, which are unable thus to be changed, are of no use whatever to the system. What is this change? It is essentially one of solution. Such substances as fat, starch, and albumen cannot be acted on by the fluid of the blood, and supposing we were to inject them into the blood-vessels, what would be the result? They would remain identically the same, and would block the smaller vessels when they circulated there. You see, therefore, that these substances cannot be made use of in the system unless they be changed. Most of them, by digestion, become altered into allied substances, having almost the same chemical formulæ, but which are very soluble in water. But fat becomes transformed into a sort of soap ; it becomes saponified and emulsified, that is, divided into innumerable small particles. It is not sufficient however for food to be rendered soluble in order that it may be of service, for, take cane-sugar (the sugar of commerce) for example, it is perfectly soluble in water, but it is of no use as long as it remains cane-sugar. If injected into the blood, it passes from it unchanged. During digestion, however, it is converted into a different kind of sugar, which is not so soluble as its predecessor, but which can be used in the process of repairing waste. So you see that food, if introduced into the system, is of no use, unless it be received by the system. Unless it is acted on by the various juices and changed into substances which can be absorbed and which can be made use of, it is the same, as far as supplying waste is concerned, as if it were never introduced. If absorbed, and if it be in a suitable condition, it is carried by the blood to the various muscles, organs, etc., and there made use of. As sleep and rest are necessary for the brain and muscles to recuperate the waste that takes place in them during the day, so also is food required in order that the body may be kept in a state of perfect restoration. The necessity for some pabulum forces itself upon us every now and again through the media of the sensations of hunger and thirst. These two conditions are referred to certain parts of our body, thirst giving rise to a sensation of dryness at the back of the mouth and throat, while hunger is accompanied with a peculiar sensation in the region of the stomach, which at first is rather pleasant, but if not appeased it becomes anything but nice, indeed, positively painful. In reality these are only local manifestations of a general condition, the state the whole body is in giving rise to the sensations, for hunger may be intense, while the stomach is filled with plenty of nutritious food. Hunger may be satisfied for a time by the introduction of any material into the stomach, even if not digestible, and therefore of no use, as it supplies the necessary stimulant to the coats of the stomach, but although this be the case, yet, it speedily returns in an intenser degree, as the general condition has not been improved. Clay and other non-nutritive materials have been resorted to to supply the want in some instances. In a like manner also, thirst may temporarily be relieved by rinsing the inside of the mouth out with water, but the same holds good here as in hunger, it speedily returns when the general condition has not been benefitted. Waste, and its necessity for repair, creates in us the sensations of hunger and thirst, these again in their turn start digestion, and the digested materials pass into the blood and on to the various tissues, there to be assimilated or changed into the several constituents of the body; then, as these become used up their want again creates appetite and thirst. This is what might be designated a "digestive cycle." We take *food* in order that the bodily wants may be supplied as regards waste. What do we mean by the word? What constitutes a food? Why are not such things as clay, etc., food? In order that you may understand the answers to these several questions I cannot do better than take a food and see its composition. The one I will select is that which is generally used to illustrate this subject, it is the one I brought under your notice prominently when speaking of the diet of a child in my last lecture. It is milk. Its selection is peculiarly useful, as it is a *perfect* food, containing all the elements necessary for the support of life, in fact, it is the only food used in the earlier periods of our existence. It has been shown many times that man can be supported solely on milk, and remain in a perfectly healthy state. Let us examine this milk. If we place a drop of it underneath a microscope we see that it is composed of two distinct elements, that is provided we are using a lens of sufficient magnifying power (300 to 400 diams). The one, an opalescent fluid, the other, small globules which are floating about. The globules give to milk its peculiar white colour. If we examine these globules we find that they are composed of particles of fat or oil, which are surrounded by a very thin envelope of casein, the latter forming a sort of skin. If we rupture this pellicle, the fat becomes liberated and floats on the surface of the milk. This is exactly what takes place in the process of butter-making: the milk is beaten or shaken violently, which causes the skins of the globules to break and the fat to accumulate on the surface. Butter then is nothing less than the fat of milk. This process of rupturing the capsules may be demonstrated under the microscope before our eyes, and the oil seen to escape by placing a drop of fresh milk on a slide covering it with a cover glass and squeezing the two together. If we take some fresh milk and add to it any dilute acid, or better still, the ferment of the gastric juice, called *rennet*, a white precipitate is thrown down, or in other words, the milk curdles, and a fluid is left which is termed *whey*. If we examine the curd we find that it consists of albuminous matter, not unlike the white of an egg, in which the particles of fat are entangled. We can by certain methods dissolve out the fat and leave nothing but this albuminous material. This albuminous substance contains nitrogen in various proportions, that element so necessary for the supportof life. If the whey which is left, after coagulation has taken place, be evaporated, a kind of sugar, called *lactose*, is left, inthe form of a hard crystalline mass, provided that necessary precautions have been taken. This sugar is very similar to the ordinary table or cane-sugar, and is closely related to that peculiar form which gives the bloom to grapes (this is the cause of their sweetness). The chemical formula for *lactose* is $C_{12}H_{22}O_{11}$, and it belongs to that group which is called Carbo-hydrates by chemists, because it contains carbon and hydrogen. The whey also contains various salts dissolved in it, these are those of the Alkalis and Alkaline Earths. The chief of them are chloride of sodium (common salt), phosphate of lime, and phosphate of iron. The only other constituent of milk is water, which enters largely into its composition, being present to the amount of 86%. We have now analyzed milk and by doing so we have seen the necessary elements of a perfect food. They may be divided into five groups :—(1), water. (2), those albuminous substances containing a large percentage of nitrogen, and which are known to the physiologist as *proteids*. These in milk consist of albumen (serum-albumen), and the casein forming the pellicles of the fat globules. (3), fats, which are also called Hydro-carbons. (4), the forms of starch and sugar known as Amyloids or Carbo-hydrates. (5), various salts.

I have classed several substances under the different groups in order that you may see to which they belong.

FOOD.

1. PROTEIDS.	2. FATS.	3. AMYLOIDS.
Albumen	Suet	Cane-sugar
Casein	Lard	Grape-sugar
Myosin (Muscle)	Marrow	Milk-sugar
Fibrin	Butter	Starch in—
Gluten	Liver oil	Sago
Gelatin	Olive oil, &c.	Tapioca
Legumin		Arrow Root
Chondrin		Iceland Moss
		Rice
		Potatoes

No food is absolutely perfect unless it contains all these several constituents.

In milk the proportions are as follows :—

Water	86·8
Proteids	6·6
Fats	3·8
Amyloids ...	3·0
Salts	0·6
	100·0

They must not only be present, but must also exist in certain definite proportions. Of course these proportions are not necessary in every article of diet, and the *rationale* of our selection of food is founded on this. Our object is to select and combine the various food-stuffs in such proportions, that what is deficient in the one may be supplied by the over-plus in the other, so that the amount of one class shall be as nearly definitely proportionate to the other as possible. Man has selected his dietary by instinct and not by physiological knowledge, and he has fallen into very few errors in his choice. Take a few of his selections and examine them from a physiological point. Fowl is accompanied by bacon, as a rule. The former is almost devoid of fat and the latter supplies the want. Take meat, when it is used at meals either potatoes or bread is used with it. Meat is a highly nitrogenous substance, but potatoes and bread are not, the former contains little or no starch, while the latter has it in abundance. Milk, rich in albumen (a proteid) is used with bread or rice, containing proteids in small quantity. Beans, devoid of fat and rich in albuminous compounds, are selected to be used with bacon rich in fat, and so I might go on enumerating a host of other examples. I have written a table of their percentages in order that you may understand these points :—

ARTICLES OF DIET.—(Percentage Composition).—Rutherford.

MEATS.

Substances.	Water.	Proteids.	Fats.	Amyloids.	Salts.
Lean Beef ..	72	19·3	3·6	—	5·1
Fat ,, ...	51	14·8	29·8	—	4·4
Lean Mutton	72	18·3	4·9	—	4·8
Fat ,, ...	53	12·4	31·1	—	3·5
Veal	63	16·5	15·8	—	4·7
Pork	39	9·8	48·9	—	2·3
Ox Liver ...	74	18·9	4·1	—	3·0
Poultry ...	74	21·0	3·8	—	1·2
White Fish ...	78	18·1	2·9	—	1·0
Eggs.. ...	74	14·0	10·5	—	1·5
Cheese ...	36·8	33·5	24·3	—	5·4
Cow's Milk ...	86·8	6·6	3·8	3·0	0·6
VEGETABLES, ETC.					
Oat-meal ...	15	12·6	5·6	63·8	3·0
Wheat-flour..	15	10·8	2·0	70·5	1·7
Barley-meal...	15	6·3	2·4	74·3	2·0
Rye-meal ..	15	8·0	2·0	73·2	1·8
Indian-corn ...	14	11·1	8·1	65·1	1·7
Peas	15	23·0	2·1	57·4	2·5
Rice	13	6·3	0·7	79·5	0·5
Potatoes ...	75	2·1	0·2	22·0	0·7
Carrots ..	83	1·3	0·2	14·5	1·0
Turnips ...	91	1·2	—	7·2	0·6
Arrow-root ...	18	—	—	82·0	—
Wheat-bread	40	8·0	1·5	49·2	1·3

Now a question naturally arises in your minds as to the suitability of a purely vegetarian diet, no one can deny that a perfect diet can be selected by a judicious combination of vegetables, as between them they contain substances belonging to all the different classes. But although it is possible to live on a purely vegetarian diet, it is necessary that certain precautions be taken in order that the digestive juices may act on the several constituents with equal vigour. A number of persons are vegetarians, but they are often unacquainted with this fact, and therefore run the risk of partial starvation. The tissues of vegetables are very hard, and unless they are carefully and well cooked the various juices are unable to act upon them, and they are therefore not converted into a state serviceable to the human organism. This cooking has to be skillfully done if vegetables are to be depended on for food, and I am of opinion that a purely vegetarian diet is not sufficient to keep a person in a perfect state of health. As a rule, the appetite fails when vegetables are wholly resorted to. Physiologists tell us that the number of red corpuscles of the blood, which are the carriers of oxygen to the tissues, become diminished, and that the brain and muscles become less active when people are fed on a purely vegetable diet, so in the face of this I think we should select our dietary from both the animal and vegetable kingdoms. But, from whatever source obtained, we must have nearly 10,000 grains of these various substances *per diem*. The following is the average number of grains required, daily, for a healthy working man :—

	GRAINS.
Albuminous matter (Proteids)	2,006
Fatty ,, (Hydro-carbons) ...	1,296
Carbo-hydrates (Amyloids)	6,234
Salts	462
	9,998

Or if we roughly express this in ounces it is :—

	OUNCES.
Proteids	4½
Fats	3
Amyloids	14½
Salts	1
Total	23 ozs.

So you see we need 23 ounces of these substances *per diem*. We also require from 60 to 90 ounces of water, the amount of course depending to a great extent on the quantity lost by perspiration. But these quantities necessarily depend on the circumstances in which we are placed, for those who have to work hard in order to obtain their livelihood require an increase in them, and the following may be taken as the diet suitable for such a case :—

	OUNCES.
Proteids	6—7
Fats	3½—4½
Amyloids	16—18
Salts	1¼—1½
Total	27 to 31

For those who require a low diet, the following will suffice :—

	OUNCES.
Proteids	2—2½
Fats	½—1
Amyloids	12
Salts	½
Total	15—16

These figures all represent perfectly dry food, and we may reckon that our food averages about 50% water, and so a healthy working man would use from 40 to 50 ounces of solid food in the usual condition as to dryness. If these figures be represented in the elements themselves, it means that we require 300 grains of nitrogen (flesh-forming producer) and 4,800 grains of carbon (heat and force forming producer), or sixteen times as much carbon as nitrogen per day. The selection of our diet naturally depends on our station in life, or in other words, the length of our pocket, because animal food is much more expensive than that obtained from the vegetable kingdom and the cheapest diet is one formed of oatmeal and milk with a little meat and potatoes. Dr. Franklin has made a table giving the relative values of foods in relation to work, and he states that the same amount of work is obtainable from oatmeal, costing 3½d., flour 3¾d., bread 4¾d., and beef-fat 5¾d., as from beef costing 3s. 6½d., and isinglass £1 2s. 0½d. So this shows us that our power for work is not so much due to the lean meat as to the quantity of fat, sugar and starch we make use of. The tables I have given as the amounts of the various substances required, gives you no idea of what quantity of meat, bread, &c., is wanted to satisfy our daily wants, so I will give you the diet of an English soldier on a home station, as this corresponds very nearly to the table I gave you for a healthy working man. It is as follows :—

	OUNCES.
Meat	12
Bread	24
Potatoes	16
Other Vegetables ...	8
Milk	3·25
Sugar	1·33
Coffee...	0·33
Tea	0·16
Salt	0·25

The meat is not quite as much as this, for about 1-5th has to be subtracted on account of the bone. This diet is found to be perfectly sufficient to keep the body up to a healthy standard. Women require somewhat less than men, and boys, of course, less again still. In cases of severe labour the proteids and amyloids must be greatly increased, and the fats must be given in somewhat larger quantities, which is apparent on comparing the tables I have given.

Having now given an outline of what constitutes a "food" let us turn for a little to the second part of my subject, that of "Digestion." The digestive apparatus of man is a rather complicated piece of machinery, but in reality it is only a more highly specialised form of that found in the lower animals. It is essentially a tube, dilated at some places and studded with minute holes or pores—the openings of various ducts, which convey the different secretions into it. The walls also contain muscular fibres which by contraction squeeze the food and make it pass from one place to another. You can easily understand, even from this rude and imperfect description, that food cannot be said to be within the body until it has passed through the membranous walls of this channel, a point I emphasized at the beginning of this lecture, therefore if the food taken be of such a nature that it cannot permeate the membrane, it must be transformed into a substance or substances that can, if it is to be of any use to the body. The object of the digestive juices is to bring about this transformation or change. Some few substances are absorbed without undergoing any change whatever, and indeed such is not necessary. Water and the various minerals are examples, although some of them undergo some change. Grape-sugar is absorbed, and the *proteids*, to which I have already directed your attention, are probably to some extent absorbed without change. Fat is profoundly altered during digestion, becoming changed into a kind of soap, and also being finely sub-divided. Nearly all the bodies classed under the heads of proteids or amyloids are all digested by the aid of ferments, as we shall see presently. The manner in which these various substances are changed forms the subject of digestion. The several juices act in two separate ways, either mechanically or chemically, mixing with the food in order to render it more watery, or acting upon it so as to completely change its character. I have not time to-night to enter into what may be termed the mechanical part of digestion, how it is that the food is seized by the lips and tongue, masticated, made into a bolus, and carried by the muscles of the gullet into the stomach, how it is there kept in motion and finally passed into the intestines, and how it is moved there by peristaltic action, but I will devote my attention to the chemical part, the various juices, and their several actions. What are the juices to which the food is subjected during its passage through the alimentary tract. The saliva, bile, gastric, pancreatic and intestinal juices. We will examine each of them separately. The first that will naturally engage our attention is the Salivary secretion, as the food first comes in contact with it in digestion. Saliva is secreted by three distinct pairs of glands, called the parotid, sub-maxillary and sub-lingnal, which are situated in close vicinity to the mouth, and are connected to it by ducts which open into it. The Parotid duct opens each side near the upper molar teeth, and it may be felt by the point of the tongue as a small spot. The other glands have small openings in connection with them in the floor of the mouth. Besides the secretions from these glands there is also a quantity of mucous poured into the mouth from the mucous glands. Saliva is a clear, somewhat viscid, fluid with a slightly alkaline reaction, and when taken from the mouth is frothy, due to the number of air-bubbles entangled in it. It is composed chiefly of water, the solids being present only in very small quantities, the chief of these being a ferment called *ptyalin*, to which the saliva owes its peculiar action on food. Its composition is as follows :—

Water ...		995·16
Solids ...	Epithelium Salivary Corps.	1·12
	Ptyalin Mucin Albumin Globulin	1·38
Gases ... (CO_2, O & N)	Inorganic solids	1·84

You see by this what a very small quantity of the ferment is present, being less than one part in a thousand. What are the uses of saliva? They may be classified under four heads, viz., 1.— Lubrication of the mouth. 2.—To help mastication and swallowing, the latter by mixing with the food so that it may be made into a form convenient for deglutition. 3.—To help us to taste by dissolving substances. 4.—Its peculiar action on starch.

The first three of these heads need no further explanation, but we will enter more deeply into the fourth as it is the one intimately connected with our subject. I have just stated that the peculiar action of saliva on food is due to its ferment. Let us then examine this ferment. It is not a ferment as the term is generally used, it belongs to the class of bodies called "unformed ferments," substances which have the power of inducing change in other substances without themselves becoming altered ; and you now see why this ferment is not wanted in large quantities, for a very small amount of *ptyalin* is able to act on a large amount of food. The ferment must not be confounded with that other class, called "formed ferments," which are low organisms which induce decomposition in any medium in which they can live and grow in size and quantity, for the "unformed ferments" act without either increasing or decreasing in amount. The *ptyalin* is the active principle of saliva and exerts its peculiar influence on starch. It converts it into a form of sugar, probably *dextrine*. It does not act on starch that has not been boiled. Now the value of this change from starch to sugar is very great, for starch will *not* pass through animal membrane, whilst sugar will. So starch, unacted on by saliva, cannot pass through the walls of the stomach, but when converted into sugar it can and does. This may easily be demonstrated. Take a small bag made of bladder, or any animal membrane, and put into it a weak solution of starch, put the bladder into a large beaker filled with water, then place the whole in a chamber at the temperature of the body, 98·6° F. and leave it for some time and you will find that if you test for starch none of it has passed out through the membrane of the bladder into the surrounding water. Now repeat the experiment, but put a little saliva in the bag with the starch and after a few hours, if you test what is in the bladder, you will find that it is no longer starch, but sugar, and you will also find that the water surrounding the bag is impregnated with sugar. So this is a conclusive proof of the action of saliva on starch, and the diffusibility of sugar. *Ptyalin* is most active at the temperature of the body, but is inactive at freezing point and destroyed by boiling. This conversion of starch into sugar goes on the whole of the time that food is in the mouth, and probably for a little while after it is swallowed, but as it cannot go on except in an alkaline fluid, it is soon stopped by the acid contents of the stomach. Raw starch is scarcely affected by the ferment, and the granules must be broken up if the conversion is to go on to any marked extent. The importance of the conversion of starch into sugar is evident from the fact that the latter passes rapidly by diffusion through the alimentary tube into the blood. This conversion stops, as we have seen, as soon as it reaches the stomach, but it begins again with renewed vigour when it comes in contact with the ferments in the juice secreted by the pancreas or sweet-bread. The food passes from the mouth into the stomach, and there comes in contact with the gastric juice. This juice is secreted by glands situated in the walls of the stomach, which open into the organ by means of pores, somewhat similiar to the sweat glands which I described to you a week or two ago. They are stimulated to activity by the passage of the food into it, being quite inactive during the fasting state. The juice is produced slowly when heavy food such as meat, white of egg, etc. is eaten, but it is caused to flow rapidly when soups, broths, and liquids containing salts, are partaken of. So now you see the scientific reason for the commencing of dinner with soup, and following it with the heavier foods, when the juice becomes more abundant. Gastric juice has been obtained, for analysis, from accidental or artificial openings made in the walls of the stomach. It is a thin, colourless fluid, and unlike the saliva by being acid in character. It is composed largely of water (about 98 or 99 per cent), its specific gravity varying from 1,001 to 1,010 (that of water being 1,000). It contains the following:

1.—*Pepsin*, a ferment which changes insoluble into soluble food.

2.—A milk-curdling ferment (called rennet when obtained from the calf's stomach).

3.—Hydrochloric acid, to the extent of ·2 per cent, necessary in order that the ferment may do its duty.

4.—Mucus and various salts.

It is secreted in large amounts varying from 22 to 24 pints *per diem.* Artificial juice may easily be prepared by cutting up the stomach of an animal (preferably the pig or calf) into small pieces and digesting it in glycerine for a few days, filtering and adding fresh pieces of stomach; repeat this several times, each time the glycerine will take up a fresh quantity, then add to this extract ·2 per cent. of hydrochloric acid, (Ashby). The effects of gastric juice on food are two: curdling milk, and changing those substances called *proteids*, which will not diffuse through animal membrane, into what is called *peptone*, a fluid capable of passing through such a membrane. These changes are brought about by the agency of ferments, *pepsin* and the ferment of rennet. The action of *pepsin* is precisely similar to that of *ptyalin*, the salivary ferment, the only difference being that the former must have acid present in order that it may act, while the latter, as you know, will only do its duty in alkaline fluids. *Ptyalin* changes insoluble, or rather non-diffusible, starch into diffusible sugar. *Pepsin*, on the other hand, changes non-diffusible meat-stuffs, known as *proteids*, into diffusible *peptone*. *Pepsin*, however, is unable to act by itself, it must have hydrochloric acid present, in order that it may digest *proteids*. This may be proved by the following experiment. Let us take three test tubes and place in each some meat-stuff, say an extract of beef. Now, to the first add some glycerine extract of the stomach or artificial gastric juice, *without* any hydrochloric acid; to the second add hydrochloric simply; and to the third some glycerine extract *and* hydrochloric acid. Place all three in a water bath to keep them at the temperature of the body. If we test them after a few hours we shall find that the first and second tubes are unaltered while the third has become changed into *peptone*. *Pepsin* resembles the salivary ferment in many respects. It can convert an immense quantity of *proteid*, as it is not destroyed by the action of digestion, in fact its power seems to be infinite, but if we go on adding meat-stuff to artificial juice we find at last that it is not changed, this being due to the want of acid as this is gradually used up, but if we dilute the fluid and add a little more acid, digestion again proceeds. The time taken over the digestion of various substances has been estimated, and it has been found that fish and egg are completely digested in the stomach in about one hour and a half, while beef, mutton and those harder *proteids* take from two and a half to three hours. Milk is quickly curdled as soon as swallowed, due to the milk-curdling ferment. The use of this ferment seems difficult to explain as the milk would be coagulated without it, by the hydrochloric acid present. Milk is often formed into such dense clots by it that it cannot be digested, and then it gives rise to gastric disturbance. Some people cannot drink milk as they find it disagrees with them, but often this may be obviated by them sipping it, as then large clots are prevented from being formed. Lime water also causes the milk to coagulate in soft clots. By the time food passes from the stomach you see how far digestion has proceeded. All the starchy and *proteid* matters have been acted upon and most of them no doubt have been converted into substances serviceable to the body, the fatty being the only ones that have escaped. The products of the digestion up to thts point, *peptone*, sugar, water and soluble salts are absorbed by the blood-vessels of the stomach and pass into the system. When gastric digestion is over the undigested food passes into the small intestine to be acted on. It consists of some *proteid* and starchy matters, fats, oil and indigestible matters, such as vegetable fibres, wax, etc. Here it meets with the secretions of the liver (bile) and sweet-bread (pancreatic juice). Let us look for a little at the bile. It is an alkaline, golden-yellow fluid in man, but green in some animals. It has a bitter taste and contains about 14 per cent. of solids. From 30 to 40 ounces are secreted daily. Its colour is due to certain pigments contained in it. Its uses may be classified as follows:

1.—It has a slight action of converting starch into sugar.

2.—It assists in emulsifying fats.

3.—It helps their absorption.

4.—It prevents putrefactive changes.

Its actions are therefore not of a very important kind, as far as we are concerned to-night, so we will pass on to the next juice, which is more important. It is the one secreted by the pancreas, or what is popularly known as the sweet-bread. The juice is a clear viscid fluid, alkaline in reaction, very similar to the saliva, but it contains a greater percentage of solids. Among these are various important ferments, and these combine the actions of the salivary and gastric secretions, hence this is the most important of all the juices. The ferments are four in number:

1.—*Trypsin*, which converts the meat-stuffs or proteids into soluble peptone.

2.—A ferment called *diastase*, which changes starch into sugar.

3.—There is a milk-curdling ferment.

4.—Also one which emulsifies and saponifies fat.

The first ferment, *trypsin*, has an action precisely similar to the *pepsin* of the gastric juice, but it is more energetic on such proteids, as the casein of milk, although it does not affect such substances as the white of egg to such a degree. The second ferment acts on starch much more vigorously than the saliva, and unlike the latter it can transform *raw* starch. The action on fats is the one peculiar to this juice. I have already pointed out that they pass from the stomach unchanged, but as soon as they reach the small intestine they are attacked. The ferment reduces the fats and oils to a fine subdivision and also holds them in suspension. It also splits them into other compounds. This fine sub-division of the fats renders them capable of passing through the walls of the alimentary canal and thus they can pass into the blood and become of service to the body. This is called its emulsifying action. By the time the food has reached this juice you see that all the various component parts of it have been acted upon—the proteids, the starches, the fats, the salts and water, and this therefore brings to a conclusion the several juices that we have to consider. You will have noticed that the constituents which are the active principles of these juices are the *ferments*. It is to these that they owe their peculiar properties. The peculiarity of these ferments is that they only act under certain conditions of heat, being most active at the heat of the body. I pointed out that saliva has no effect on starch in a very cold temperature and that it is destroyed by boiling, and the same holds good of the others. They will also only act under certain conditions as to acidity and alkanity, the saliva must be alkaline the gastric juice acid and so on, and sometimes indigestion may be attributed to faults in these. Under certain conditions, the saliva becomes acid, sometimes due to bad teeth and the decaying matter contained in them, and then it most certainly does not act, hence the importance of always keeping the teeth clean and attended to. The secretions are not constantly being poured out, being only stimulated by the presence of food. The saliva, and it is true also of the other secretions, keeps the mouth moist, but a copious flow does not take place except when the food enters the mouth, or in some cases by the mere thinking of it. Now for this secretion, for this activity of the glands, a large supply of blood is necessary, so anything that takes away blood from them during the process of digestion naturally impedes or stops it. If we have to work with the brain or muscles to any extent immediately after a meal, blood is drawn away from the digestive organs into the brain or muscles, as the case may be, and digestion is therefore retarded. Thus we learn the lesson that if possible we should rest from all exercise for a little while after meals, and Nature here dictates to us, for we generally feel disinclined for any exertion after a hearty repast. So you see how Nature wisely orders all things. Having traced the destiny of the various food-stuffs, let us look at what becomes of an ordinary meal, in order that the several points may be impressed on your memories. Let us take dinner for an example. As soon as the bread, potatoes, meat, etc., enter the mouth they are divided and sub-divided by the front cutting teeth into small particles and are then ground by the molar, or back teeth, which have flat surfaces for the purpose of forming them into masses. The entrance of the food and the process of mastication cause a copious flow of saliva to take place and it mixes with the food. The starchy matters are at once attacked by the salivary ferment and converted into sugar, and this transformation takes place with marvellous rapidity. The fatty matters and meat-stuffs, or proteids, are unaffected. The salts (which are soluble) and sugar are dissolved by the water of the saliva. The food-mass is then made into a bolus and swallowed, it then enters the stomach, where already some gastric juice has been secreted by the stimulus of food in the mouth. This juice goes on being secreted while the food bit by bit enters the stomach, and the latter by contraction of its muscular walls moves the food about, and thus it becomes intimately mixed with the gastric secretion. The salivary ferment is destroyed by its acidity. The milk-curdling ferment makes any milk swallowed into a curd, and the whey becomes separated. The ferment, *pepsin*, attacks the curd and other meat-stuffs which swell up and become dissolved into soluble peptone. Any fat remains unaltered, and any starch that has not been converted into sugar is also unaffected. Sugar, that is cane-sugar, becomes transformed into grape-sugar, as that is the only form in which it can pass into the blood, this may seem strange to some when they know how soluble cane-sugar is. After a time, which varies with the quantity of the food taken, and which I pointed out may be from about an hour, as in the case of an egg, to three or four hours, when meat is used, all the food is digested and it passes into the small intestine. Here it comes in contact with the secretions of the liver and sweet-bread and they are produced more abundantly by the appearance of the food coming from the stomach. The fluids are alkaline, and just in the same manner as the salivary digestion is stopped by the acid gastric juice, so the latter is stopped by these juices. Those proteids or meat-stuffs which are undigested are attached by them and are changed into soluble peptone, the action on starch also begins afresh, and the fats which up to the present have not been changed are divided into minute particles which are suspended in them, and the resulting solution looks not unlike milk. Thus the several parts of the meals are changed into a state so that they can pass through the walls of the alimentary tract, where they are taken up to be used for repairing the waste necessarily accompanying our existence. Having taken a brief survey of the process of digestion, what rules can we draw from it in order that digestion may proceed under as favourable conditions as possible. The first point that strikes one is the necessity for the food to be well masticated before being swallowed in order that the several particles may be torn abroad, and that the saliva may have every opportunity of acting on the starchy granules. If it be not well masticated when it passes into the other parts of the alimentary tract it remains unaltered, and therefore gives rise to irritation and likewise discomfort. The next thing to which I would like to refer is the desirability of resting after a meal, if it be large enough to be designated as such. I have already pointed out that severe muscular or mental work causes blood to be drawn off from the digestive organs and that they are thus weakened at the time. It is therefore obvious that such should not take place immediately after a meal. Of course some will naturally say, how can it be avoided by those who have to work almost continually during the day, and who can only have about an hour to dinner? My answer is, why should they not adopt their meals to their circumstances, if they cannot rest after them? I think it would be preferable for them if they arranged some plan like the following. Let them take a really good breakfast about an hour before they start for work, and at mid-day partake of some very light refreshment, which ought to be substantial—milk, bread, fish, etc., and then have dinner when they get home at 6 o'clock. If the luncheon be mild no feeling of torpor or drowsiness will follow, nor will any feeling of emptiness or prostration precede the dinner. The dinner should be good but not excessive, and after it the necessary rest ought to be taken, which may be occupied by the reading of the paper, etc., but no severe mental work should be indulged in for an hour or so. I think some such arrangement as the one I have pictured would be found to work satisfactorily, both from a social and a hygienic point of view. After dinner a cup of tea or coffee is found to be refreshing, and it is harmless to most people, but some are so affected by it that they cannot indulge in it after three or four in the afternoon. There can be no doubt that the dinner time is best to be about the middle of the day, as then all the powers, including those of digestion, are higher than in the evening, in fact, as far as this is concerned, it would be the best early in the morning, but of course this could never be practically carried out. The utility of good cooking, which includes the selection of the proper quantities of the various food-stuffs is also obvious. Cooking renders the various particles soft, and loosens them so that they can easily be affected by the gastric juices, and it is therefore essential that it should be properly conducted. These are a few of the practical hints on the hygiene of food. In some people the digestive juices are either too weak or are produced in too small a quantity, and then we have recourse to artificial digestion, and so before concluding this lecture I should like to make a few remarks on it. All the digestive ferments may be separated by very simple processes, and they can be obtained in any quantity in the market, The ones that are used are Pepsin, obtained from the pig, and the Liquor Pancreaticus. Pepsin and hydrochloric acid taken either before or with a meal will digest the food in the stomach. But food may be digested outside the body. Beef-tea or milk-gruel may be done in the following manner: boil one half of it and mix it with the other half and stand it near the fire, then to this add the preparation of the pancreatic ferments in the proportions which accompany the bottle, keep it warm for about one hour to an hour and a half and then boil to stop any further digestion taking place. The resulting fluid is then taken. It is found to be agreeable to the palate unless the digestion is carried too far, for then it becomes insipid. The food should always be freshly prepared. The pancreatic ferments are the only ones used for digestion outside the body or 'peptonizing' as it is called, as it is found that the pepsin preparations always produce a bitter and very unpleasant fluid and it is therefore unpalatable. The pancreatic ferments on the other hand are useless for giving before or with food, as they are destroyed by the gastric juice. While speaking on this subject I should like to draw your attention to the Peptonizing Powders of Fairchild, prepared by Messrs. Burroughs, Wellcome & Co. For predigesting cow's milk, no more convenient or effective article can be had, and for the infant or invalid when cow's milk is found to irritate the digestive apparatus, one tube added to a pint of milk will render it easy of assimilation. Their convenience and efficacy are the two points which make them highly to be recommended in any case where artificial digestion is called for. The artificial digestion of food outside the body is a comparative recent invention and it has enabled the medical profession to grapple with a number of complaints with great success, and those who worked at this subject for our benefit are, I am sure, deserving of the greatest encomiums and praise that we can give. Foods can also be procured partly digested and those who suffer from that common complaint—Indigestion—will find they can derive much benefit from their use. There are many other facts relating to this subject that I should like to go into if time permitted, but I have endeavoured to bring the most important under your notice. I have gone rather fully into the manner in which the food becomes digested as I thought that if I fully explained it to you I should have given you a good foundation on which you could work out for yourselves some of the principal hygienic rules which should guide you in the selection of your food, and also help the process of digestion. I trust that my endeavours in the various lectures I have delivered, although feeble, for no one knows better than the lecturer how far they have fallen short of the standard aimed at, will not be without their fruit, and if they have been the means whereby departure from health, in some cases, has been averted, their object will have been fully realized for "Health is better than Wealth."

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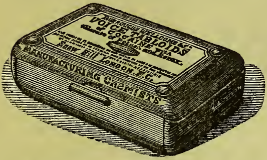
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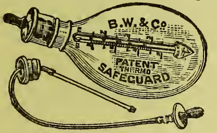

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